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Development of Machine Tools in New England

By GUY HUBBARD

The fifth article—Invention of the bandsaw—Two rotary pumps, one a failure and the other a marked success—A patent signed by John Quincy Adams

IN PARTNERSHIP with his son George W. Hedge and Edwin F. Johnson, Lemuel Hedge set up as an inventor and mechanical engineer in New York, being especially interested in the improvement of sawmills. On June 18, 1842, he patented one of the early types of circular sawmills for sawing logs. As perfect saw plates of large diameter were difficult to produce in those days, he employed two rather small saws, one set above and ahead of the other so that their cuts would come together—an arrangement which, in large sizes, was later used a great deal in the big mills of the west. In this Hedge mill, the log was stationary and the saws moved forward, a long belt passing over one saw-pulley, under the other and then over an idler, allowing the saws to move without disturbing the drive.

In May, 1849, Lemuel Hedge produced his most famous invention, which was the bandsaw in almost exactly

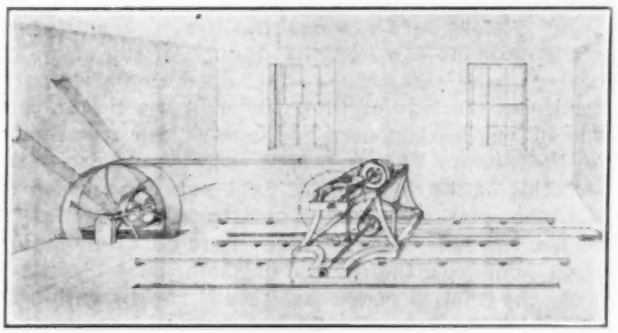

FIG. 23—HEDGE'S DOUBLE CIRCULAR SAWMILL
(Drawing by Lemuel Hedge)

its modern form. To get ahead of my general story I will say that this machine, now in increasing use for cutting both wood and metal, was originally built for Mr. Hedge by The Robbins & Lawrence Co., Windsor, Vt., and was first demonstrated to the public at its car shop in August, 1849. Of this demonstration, the *Vermont Journal* of August 24, 1849 had the following to say:

"The Belt Sawing Machine" advertised in our columns seems, on investigation, to justify if not demand further notice at our hands. Its remarkable simplicity and adaption to all possible purposes ever effected by saws, cannot fail, if known, to command the attention of mechanics. It is capable of sawing on straight lines or on curves of any radius down to ¼ of an inch. Its natural adjustment ensures its working at exactly right angles from any sur-

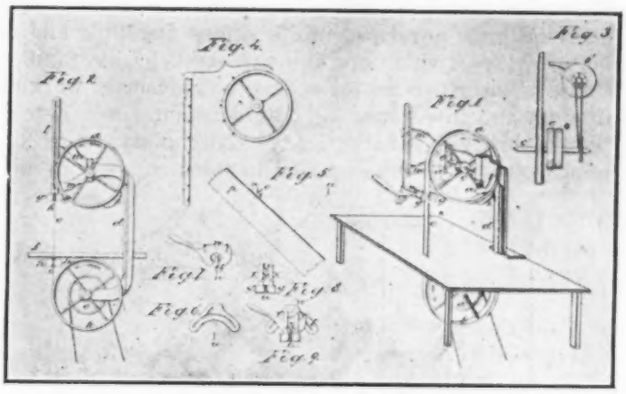

FIG. 24—HEDGE'S BANDSAWING MACHINE, 1849
(From the patent drawing)

face of the timber to be sawed, but is easily adjustable to saw through the timber at any desired angle, whether the line in which the saw progresses be straight or curved. It is capable also of sawing tortuous or winding surfaces, and this, also, whether the line of progession be straight or curved; this property enables it to saw every species of ship timber, mould boards for plows, etc., thus annihilating to a certain extent the use of the adze. As a sawmill for lumbering purposes, it is adapted to saw with equal facility, boards of any width, up to ten feet or more, if required. To keep it sharp, and otherwise in good order for work, requires, in the opinion of the best judges, to do the same amount of work, less labour than ordinary saws It has also the advantage of cutting a kerf by one half thinner than the common sawmill, by which means an important amount of lumber is saved. It is cheap in its construction, and not liable to disorder save by necessary wear or accident. But to cap the climax of its advantages, it is evident that with less than one half the power, it will execute twice the amount of work in the same time,

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when compared with the execution of the common sawmill. We hope the inventor may find sufficient enterprise in this place to patronize so valuable an improvement.

Hedge's belt sawing machines were later exhibited at London, Paris and Vienna and received considerable attention. They first came into general use (in small sizes) to replace jig saws, but of late years the prophecy of the old newspaper item has come true, for in the

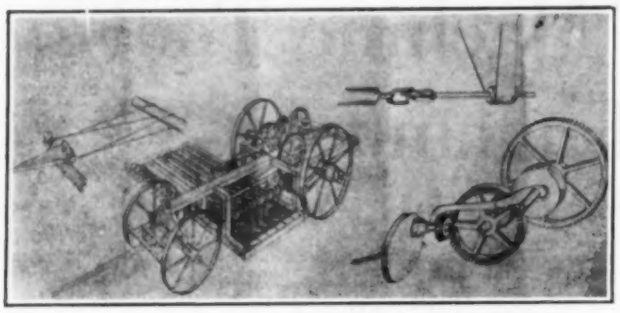


FIG. 25—HEDGE'S GRAIN REAPER, ABOUT 1855
(Drawn by Lemuel Hedge)

lumber mills of Oregon and California, heavy and powerful band saws have now generally replaced Hedge's earlier invention—the double circular saw—for handling the huge logs of these regions.

Lemuel Hedge combined many qualities. He was, in his youth, a fine cabinet maker and there is no question but that the handsome furniture he made in his younger days is now highly valued as heirlooms by the descendants of the original owners. Then to this accomplishment, he added that of a builder of fine musical instruments—an art in itself. Beginning his career as a blacksmith, he developed into a skilled mechanic and as his drawings (which are still preserved by his family) show, he later became an exquisite draftsman, working in tints and in perspective. By constant study he cultivated his great natural inventive ability, until his mind was able to conceive and to work out delicate and

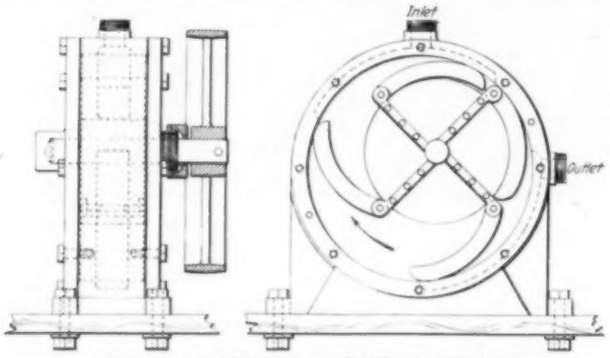


FIG. 26—COOPER'S ROTATIVE PISTON

complicated mechanisms so completely that no great amount of experiment was ever necessary upon the finished machines. In his later life he was in comfortable circumstances and he died in New York at about the age of eighty, an active engineer almost to the last—being in his old age engaged in the perfecting of a grain reaper. As the biographer of Oliver Evans might have said "Lemuel Hedge has a memorial whereever paper is ruled, wherever band saws are in use and, most of all, in certain departments of the great Stanley Works of New Britain, Conn., where accurate scales are made. Besides being one of the earliest Windsor mechanics and inventors, he was one of the greatest and the writer is proud of this opportunity to bring Mr. Hedge and his work to general public attention for the first time.

On July 16, 1827, John M. Cooper, an inventive mechanic of Guildhall, Vt., received a patent upon a device which he called a rotative piston. This device was designed for use in pumping water, the object being a pump to which continuous rotary motion could be directly applied and from which a continuous stream of liquid would be expelled, without the use of an air chamber.

The rotary pump as built with the Cooper rotative piston, shown in Fig. 26, consisted of a cylindrical casing with an inlet at the side and an outlet at the top, these openings connecting with cored recesses on the inside. The casing was bored out and fitted with bolted-on cylinder heads. The rotative piston revolved within the casing, being supported by eccentrically located bearings in the cylinder heads. It consisted of a drum with a shaft through the center, the drum being considerably smaller than the diameter of the bore of the cylinder and in width, the same as the space in the cylinder. Equally spaced about the drum were four curved leaves or buckets, which were pivoted at one end to straps set flush with the sides of the drum. The buckets were sections of a ring, the inside diameter of which was the same as the drum. In thickness, the buckets were the same as the clearance between the drum and the bore of the cylinder at the closest point and in length, they were one fourth the circumference of the drum. The free ends were rounded to slide smoothly on the case and the fixed ends were drilled for the pivot pins and counterbored to fit the eyes of the straps, the ends being carefully rounded to maintain a tight joint with the surface of the drum.

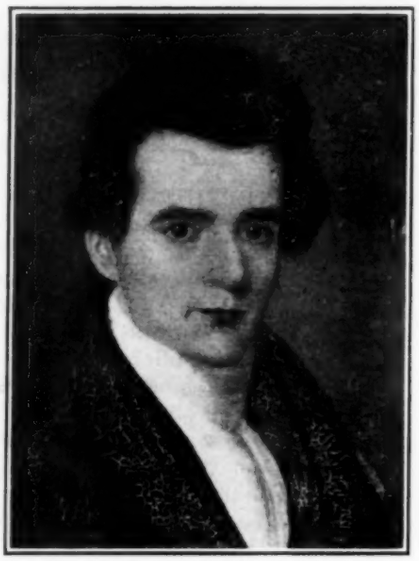


FIG. 27—ASAHEL HUBBARD. INVENTOR OF THE REVOLVING HYDRAULIC ENGINE
(From an old painting)

As the rotative piston was turned rapidly within the casing, the buckets were thrown outward by centrifugal force and by liquid pressure and came in contact with the casing, being opened and shut during each revolution by the eccentric action of the case. This caused the liquid to be constantly squeezed out at the top and a vacuum created at the intake, thus constantly drawing in more liquid from the reservoir.

Cooper believed his revolving piston to be particularly suited for a combination bilge and fire pump for steamboats, as it could be driven by hand or belted to an engine with equal facility. For this reason he went to Windsor where the steamboat excitement was then at its height, and in the winter of 1827, (even before

thorough tests had been made) he persuaded two local capitalists, Elisha Phelps and Edward R. Campbell, to finance his invention. The partnership of Cooper, Phelps & Campbell was formed in March, 1828, and preparations were at once made to manufacture Cooper's rotative piston on a large scale, in one of the abandoned buildings of the defunct Essex Merino Association, on the second fall of Mill Brook in Windsor Village. In addition to the ship pumps, fire engines and well pumps with the rotative piston were designed and it was confidently believed that high-pressure industrial pumps, as large at 20,000 gal. per min. capacity, would be entirely practical upon this plan.

So great seemed to be the field for this invention to the optimistic backers, that on Oct. 30, 1828, Cooper, Phelps & Campbell, incorporated at Windsor as the American Hydraulic Co., with a capital of $100,000. A representative was sent to Europe, numerous agents were appointed and plans were made for greatly enlarging the business at Windsor. A force of fifty men was set to work, hundreds of pumps of various sizes were turned out and because of the extravagant claims made by the agents, the pumps sold rapidly.

No sooner had this production been reached, however, than the extremely unpleasant discovery was made that the pumps, especially those of the larger size, by no means came up to the expectations in actual service. One drawback which appeared (even in the experimental model) was that as the head was increased, the greater became the sliding friction of the piston and the consequent wear and loss of power, on account of the buckets being forced against the inside of the case. This fault was particularly evident when gritty water was pumped. Another defect which appeared was that of slip or leakage within the pump itself, not only between the buckets and the case but at the hinges of the buckets as well. This defect would appear even in a new pump unless very carefully constructed.

The result was that many of the hundreds of pumps already sold began to be returned and the sales of new ones rapidly fell off. With the crude mechanical equipment available in those days, the Cooper pump could scarcely have been improved upon and the upshot of the matter was that about 1830, the American Hydraulic Co. failed—both Mr. Phelps and Mr. Campbell losing considerable amounts of money in the venture. It is pleasant to know that of late years the Cooper rotative piston has been improved greatly and as built by careful modern methods, it is sold under a variety of names both as low-pressure blowers and as pumps for liquids, which give excellent results.

It so happened that had it not been for the following fortunate circumstance attending the advent of the Cooper pump, the heavy blow of this initial failure might easily have killed the Windsor machine industries almost at birth. This circumstance was, that one of the Windsor citizens to whom John W. Cooper demonstrated his rotative piston shortly after the patent was granted, was a sort of "Jack of all Trades," Asahel Hubbard by name, who was at that time running a combination of sawmill, gristmill, and machine shop about three miles west of Windsor village, at a wild and picturesque fall in Mill Brook at the base of Mount Ascutney.

The United States of America.

TO ALL TO WHOM THESE Letters Patent SHALL COME:

Whereas Asahel Hubbard a Citizen of

the United States hath alleged that he has invented a new and useful improvement

in the Revolving Hydraulic Engine

which improvement hath not been known or used before his application, hath made oath that he does verily believe that he is the true inventor or discoverer of the said improvement, hath paid into the treasury of the United States the sum of thirty dollars, delivered a receipt for the same, and presented a petition to the Secretary of State, signifying a desire of obtaining an exclusive property in the said improvement, and praying that a patent may be granted for that purpose. These are therefore to grant, according to law, to the said Asahel Hubbard

his heirs, administrators or assigns, for the term of fourteen years from the twenty second day of April one thousand eight hundred and twenty eight the full and exclusive right and liberty of making, constructing, using and vending to others to be used, the said improvement, a description whereof is given in the words of the said Asahel Hubbard himself, in the schedule hereto annexed, and is made a part of these presents.

In Testimony whereof, I have caused these Letters to be made Patent, and the Seal of the United States to be hereunto affixed.

GIVEN under my hand, at the City of Washington, this twenty second day of April in the year of our Lord one thousand eight hundred and twenty eight and of the independence of the United States of America the fifty third.

J. Q. Adams

BY THE PRESIDENT.

H Clay Secretary of State

City of Washington, To Wit:

I DO HEREBY CERTIFY, That the foregoing Letters Patent were delivered to me on the twenty second day of April in the year of our Lord one thousand eight hundred and twenty eight to be examined, that I have examined the same, and find them conformable to law, and that they were returned on the same day to the Secretary of State, to obtain the seal of the United States thereto, and from the date aforesaid, to wit, on the twenty second day of April in the year aforesaid.

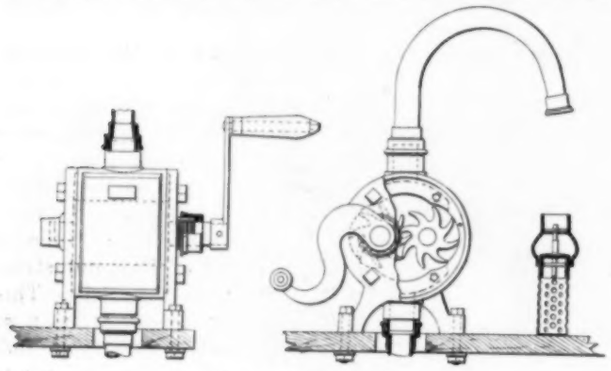
FIG. 28—FIRST PAGE OF LETTERS PATENT ON HUBBARD'S REVOLVING HYDRAULIC ENGINE

Asahel Hubbard, whose portrait is shown in Fig. 27, was born at Meriden, Conn., Jan. 8, 1787, and removed to Windsor in 1800, where his father had for twenty-five years been one of the large land holders. As a boy he drove freight wagons between Windsor and Boston and later he ran a store for a time and also was a tavern keeper but, being a natural mechanic and inventor, he drifted into mechanical work.

When he saw the Cooper pump, he at once appreciated the value of the revolving principle but detected the grave faults mentioned above. With his interest thus aroused, he set to work to invent a rotary pump which would avoid the faults of Cooper's rotative piston and its complication of parts, yet still have its advantages. The result was his revolving hydraulic engine, upon which he obtained a strong patent, dated April 28, 1828, signed by John Quincy Adams, President; Henry Clay, Secretary of State and William Wirt, Attorney General. It was upon this patent, the first page of which may be seen in Fig. 28, that the modern industries of Windsor were based.

The revolving hydraulic engine, Fig. 29, is clearly though rather quaintly described by the inventor in the patent, in the following way:

"This is an engine for raising and discharging water and other fluids. It consists of two metallic or wood cylinders with curved leaves, which play or mash into each other, the rounding side of the leaves coming in contact



(From the original)
FIG. 29—HUBBARD'S REVOLVING HYDRAULIC ENGINE

—the hollow sides forming buckets for the conveyance of the fluid. Each cylinder revolves on an axis, and may be placed either in a horizontal or perpendicular position. The cylinders may be confined in a metallic or wooden box strongly bolted or screwed together, the inside of the box corresponding with the form of the two cylinders when placed together. In the lower part of the box (if the cylinders are placed in a horizontal position) is an aperture of sufficient capacity to keep the box filled with fluid when the engine is in operation, the size of the aperture graduated by the size of the engine. A pipe or tube is introduced, which will fit the aperture, of sufficient length to reach the reservoir, or fountain, intended to supply the engine. At the top or side of the box, as occasion may require, is another aperture, to which a suitable pipe is attached to discharge the fluid, the form and size adapted to the use to which the engine is applied.

This engine may be operated by hand, horse, steam or water power, and any kind of cranks, wheels, bands, chains, pinions, cogs or pulleys, may be applied, that will give the cylinders a rotary motion, the particular application depending upon the size of the engine, the purpose for which it is intended, the quantity of fluid required to be raised, and the valocity with which it is necessary to be discharged.

For a small hand engine, a crank is attached to the axis of one of the cylinders; by turning the crank both cylinders are put in motion, which raises the fluid thro' the tube at the bottom and discharges the same at the top or thro' the pipe on the upper side of the engine." ASAHEL HUBBARD.
Witnesses:
THOS. M. POMROY,
CARLOS COOLIDGE.

In this pump there are but two working parts. There are no sliding joints (the action of the "leaves" being a rolling one) and increasing pressure has scarcely any effect in increasing the friction. Thus were the advantages of the rotative piston retained and its defects eliminated.

Teach Your Boy a Trade—Discussion

BY WILLIAM J. FISHER, JR.

There was a very interesting article in the *American Machinist* on page 872, Vol. 58, by W. H. Myers, advising us to teach our boys a trade. There is much in the article to make us wonder where we are going to get our future mechanics.

I well remember that when I applied for a place to serve my apprenticeship, there were eighteen to twenty boys ahead of me and all of them had to have letters of recommendation—and these letters were from influential men. Not so now; if you need a boy to learn the machinist trade you have to look him up.

A short time ago I asked an employment bureau head if many boys applied for places to learn a trade, and he said, "No, they seem to be looking for something cleaner than working in shops, and they do not like apprenticeship wages." Boys today learning a trade receive about four times as much pay as formerly, have shorter hours, and many other advantages that boys of the past generation did not have.

IMPORTANCE OF THE MACHINIST

Surely the machinist trade is an honorable one and has the brightest of prospects, as there is not a large engineering project of any kind that is not dependent on machinists directly or indirectly for its successful accomplishment. I remember an executive in a large rolling mill near the shop where I served my time, who not from necessity sent his boys into our shop and had them learn the machinist trade. It certainly was an advantage to them when they went into the mill.

Where is there any trade that is more interesting than the machinist trade, or offers better prospects in these days of wonderful machinery for both farms and city? Perhaps if the *American Machinist*, with its large influence in the machinery business, would publish more articles on the prospects of the machinist trade, it would help fill up the ranks of one of our most interesting occupations. It is much to be regretted that boys today when they come out of high school or college, seem to look for places where they can have clean hands and clothes.

While I feel that I am in the minority, I still believe that the old-fashioned apprenticeship system is the best; that is, serving time in a machine shop with real machinists after having received instruction from vocational teachers.

Automobile Piston Clearance—Discussion

BY E. JACKSON

I notice on page 65, Vol. 59 of the *American Machinist* an article under the above title by Otto M. Burkhardt. I fear that he is under the impression that the piston is the only part of the engine which expands.

While he is correct in the figures he has taken as regards the expansion at the temperatures specified, he has not said how much the engine block, or cylinder, will expand.

From experience and figures that I have taken and applied, I find that the expansion of the automobile engine is 0.007 in. for the block and 0.016 in. for the piston. I feel that the chart D. P. Muirhead has given is as close as one could devise, figuring on the expansion of a 4-in. piston. I also find that it makes a difference whether you have a four-cylinder or six-cylinder engine. In a "four" I make the No. 1 piston about 0.002 in. larger than I do the other three as it seems to get the most severe wear. But on a "six" I make them all the same.

Emergency Repairs on a Gold Dredge Gear

By FRANK C. HUDSON

Saving undue delay on a million-dollar dredge—Reinforcing a cracked hub with heavy plates shrunk and bolted into place—Simple but sturdy repair work

GOLD DREDGES run so heavily into money that it is necessary to keep them in operation as constantly as possible. Every day of delay on a plant which costs in the neighborhood of a million dollars, has a very disheartening effect when it comes to figuring out dividends.

It so happened that the main driving gear of a large gold dredge developed cracks in and near the hub,

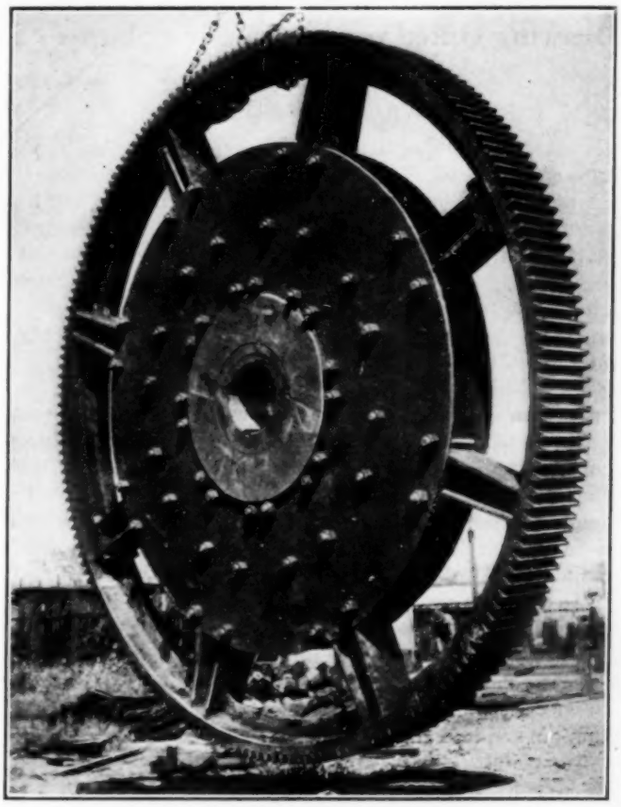


FIG. 2—SHOWING BOTH PLATES AND THE CONNECTING BOLTS

and it became necessary to either repair it or get a new gear. So the Yuba Manufacturing Co., at Marysville, Calif., tackled the job of repairing the old gear.

The gear was about 14 ft. in diameter, or 168.426 in., to be exact, and had a 15-in. face. The first operation was to turn down the outside of the hub to 26 in. in diameter. Then reinforcing plates were shrunk on each side. The first or inside plate on each side was 10 ft.

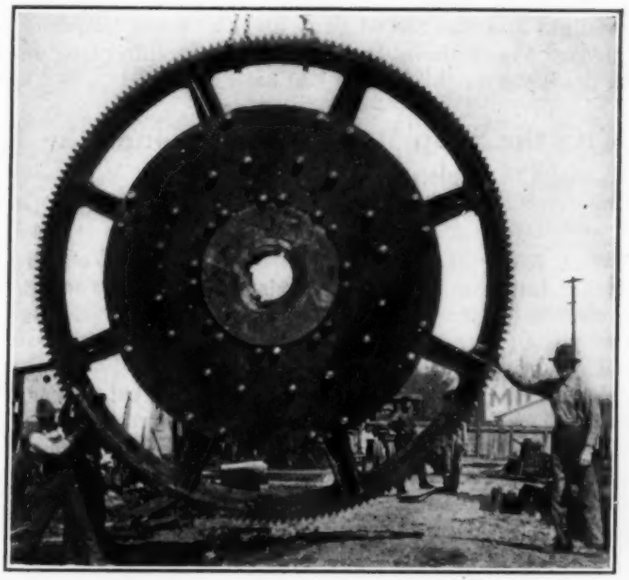


FIG. 1—A SIDE VIEW OF THE REPAIRED GEAR

in diameter by 1¾ in. thick, and the second or outside plate was 48 in. in diameter and of the same thickness. Fig. 1 gives an idea of the size of the gear, as well as the arrangement of the plates.

Before shrinking on the large plates, however, it became necessary to cut a recess out of the flanges of the

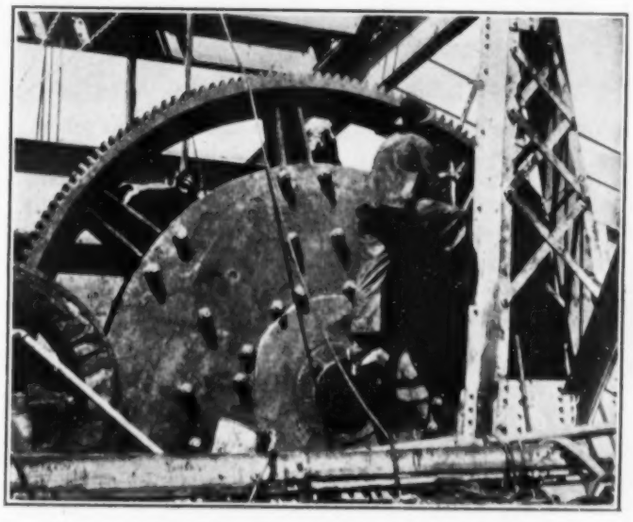


FIG. 3—PUTTING THE GEAR BACK INTO PLACE

eight arms, which were of I-section. The first side of the gear was entirely recessed in this manner on a 10-ft. Betts boring mill with the housing run back to the extreme limit. On the second side, however, it was decided to try cutting out nearly all the metal from the flanges with an oxy-acetylene torch, leaving the boring mill to finish the surfaces to uniform dimensions. This procedure was found to be very much quicker than cutting it all out on the boring mill.

After the arms and the hub were properly surfaced on both sides the plates were shrunk on. The smaller or outside plates were welded to the large plates by means of the electric arc. Six holes were then drilled close to each arm to receive 2-in. bolts having nuts on each end, there being 48 bolts in all. The bolts were made of chrome-vanadium steel. Fig. 2 shows how the repaired gear appeared.

The cracked wheel reached the Yuba plant on a Tuesday night and was carted away at 11 a.m. the following Friday. Fig. 3 shows the gear being put into place on the dredge after the repairs had been made.

Give the Shop Man a Visit Through the Shop—Discussion

By James Vose

With respect to the editorial on page 776, Vol. 58, of the *American Machinist*, under the above heading, it may be of interest to note that the idea of taking men through their own shops was put into practice in England quite a number of years ago.

A custom grew up in Manchester, and lasted at least a few years, of shop groups, comprising representatives of principals, technical and office staffs and shopmen, visiting other shops and tool warehouses on Saturday afternoon, the compliment being returned by inviting the representatives of the visited shops to inspect the shops of the visiting groups.

As is suggested in the editorial, much good was accomplished by these mutual visits. For one thing, it increased the knowledge of their own products and methods on the part of the various works hosts, and helped to give the workmen a self-respecting interest in their daily work and shop surroundings. It also brought together, in a social capacity, the representatives of the various departments and crafts in the shops of the district, since the visits usually concluded with the serving of light refreshments and congenial chats on shop topics and problems.

Those Participating

Among the works taking part in the informal scheme may be mentioned Mather & Platt, John Hetheringtons, B. & S. Massey, Meldrum Bros., George Richards, British Westinghouse Co., Hans Renold, Brauphaus, Browelt & Lindey, Charles Churchill, etc. In some cases printed programs were prepared and distributed. These served as a reminder of the various machines and processes inspected and led to more systematic and helpful ways of showing visitors in general through the shops at other times.

The effect on the workmen was sufficiently marked to call forth comment from incidental visitors regarding the noticeably more intelligent, knowledgeable and self-possessed bearing of those who had participated, not only in visiting other shops, but also in doing the honors at their own shop.

It occurred to the writer that what was appreciated sauce for the visitor goose should serve equally well for the resident gander. As a consequence, a visit to the shop by the regular personnel was arranged, the guests being piloted through by the specialist stewards exactly as in the case of outside visitors. The party afterwards adjourned to a social evening provided by the company, the music being contributed principally by the guests themselves. Full particulars were given at the time in this journal and commented on by the New York editors under the heading of "How to Show the Shop"—An English Improvement. (Page 1090, Vol. 25.)

This was in 1902. The visit was even more successful than the group affairs, and bore out fully the conclusions reached in the recent editorial article. One general result of the group visits was to give to the participants a more comprehensive grasp of the leading engineering productions of the district, thus helping forward the creation of good public spirit. The specialized publicity gained was also mutually advantageous to all parties in the groups.

I do not expect anyone would claim special credit for the idea of men being invited to visit their own shop, but, like many other useful innovations when accomplished, it only seems just plain common sense.

Drawing Office versus Machine Shop—Discussion

By William H. Kellogg

Referring to the article with the above title by F. P. Terry on page 867, Vol. 58, of the *American Machinist*, it is apparent from what he says that there must be some friction between the management of the two departments in question. Inasmuch as the existence of such a condition suggests the searching out of its cause with a view to finding a remedy, the writer would mention three fundamental causes that usually underlie troubles of that kind.

The first cause may be traced to the fact that the concern has in charge no competent engineer, with experience as a shop man as well as being a fully trained technical man. This condition would lead up to the second cause; namely, that there is a tendency to employ draftsmen who are not qualified to do the work, due to the fact that drafting work is very often underestimated. This condition, in turn, leads to the third cause; that the shop is left largely to its own resources. Inasmuch as the shop is not equipped with drawing material, instruments, files and the like, nor with men skilled in designing and checking, it cannot very well be expected to remedy the deficiencies of the drafting room. Much less could it make designs, check drawings or prepare stock lists.

If a fully qualified engineer were in charge of the shop and drafting room, having equal authority over heads of both departments, differences could be referred to him and disputes would be readily settled. Such a man would employ only competent draftsmen, as he would realize that every hour well spent in drafting work would mean a saving of many hours and much material in the machine shop.

There is a growing tendency among the best manufacturers to eliminate waste by beginning the job right with the best trained help, and the right place to begin is in the drafting room.

Manufacturing the Slocomb Center Drill

SPECIAL CORRESPONDENCE

Operations of manufacture largely automatic—Much special machinery used—Relief is made before fluting —Grinding and sharpening the drills

WHEN the combination center drill and countersink first made its appearance on the market something over a quarter of a century ago the machinists and toolmakers of that day accepted it grudgingly and with many reservations, mental and otherwise. A tool that would do in one operation what had heretofore been done very comfortably in two was not altogether welcome; and, besides, it was an apprentice boy's job to drill centers, anyway.

It was not long, however, before the little tool had demonstrated its right to a place in every tool crib and

FIG. 1—BATTERY OF AUTOMATIC TURNING MACHINES

kit and, as the trend of the times became more and more in the direction of intensive production, the saving effected by combining the two simple operations, insignificant though they were of themselves, assumed greater importance until now the manufacture of combination center drills has become a separate industry, requiring whole departments, or even shops, each with special machinery and skilled operatives devoted to its production.

Without going into exhaustive research to determine to whom should be given credit for priority of invention, it may be said that the J. T. Slocomb Co. was the first to make the tool a commercial possibility, and the methods and machinery here described are in use in the plant of the above named company in Providence, R. I.

Fig. 1 shows a battery of the turning machines that form the ends of the drills, not only turning the stock down to the diameter of the drill on both ends simultaneously, but forming the "relief" on the lips of the countersink at the same time.

The round bar stock is first cut up into pieces of approximately the overall length of the finished tool and without further preparation these pieces are fed into the hoppers of the machines, each machine being set for a certain size of drill. The machines shown in Fig. 1 are all alike except in the matter of size, and each machine is capable of producing a range of drill sizes.

Fig. 2 shows a single machine, being the end one of the row shown in the preceding illustration. The "hopper" is the inclined part about midway of the machine and directly behind the splash guard. It is open along the upper side and confines the pieces only at the ends, with an inwardly projecting strip about half an inch wide to cover just enough of the blanks at the ends to prevent any one blank from being forced out of line by the weight of those above.

The blanks roll down the incline by gravity and at each cycle of the machine the lowest blank in the stack is transferred to the chuck, or vise, at the center of the machine, where it is held stationary and in line with the revolving tools until the turning is completed.

The tools are of the ordinary box type, familiar to

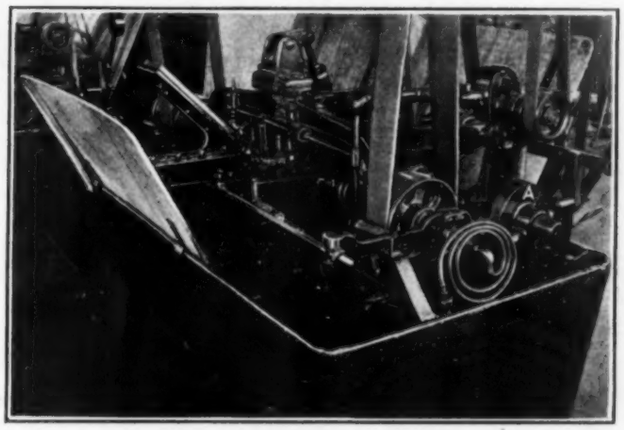


FIG. 2—ONE OF THE TURNING MACHINES

all screw machine operators. Both are right hand, and they are revolved in opposite directions by means of open and crossed belts so that the torsional effect of the cut is practically balanced and no undue strain is imposed upon the holding fixture. The tools are fed forward by cams, and until they have reached nearly the limit of their movement there is no unusual action.

The cams transmit the feeding movement to the spindles through spring suspended levers in such manner that it may be interrupted or modified by other cams without interfering with the steady advance of the feeding cams; the variation being absorbed by the springs. The cams, one of which may be seen at *A* in Fig. 2, are mounted upon a worm-driven shaft at the

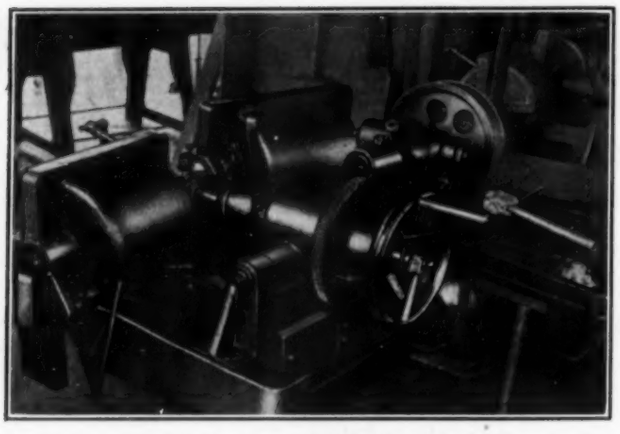


FIG. 3—MILLING THE FLUTES

back of the machine. They have a single uniform rise with an abrupt drop to the starting point, a complete revolution of the cam shaft corresponding to one cycle of the machine. The lever and yoke by means of which the movement is transmitted to the spindle may also be seen in this picture, as well as the spring suspension feature at the end of the lever.

Upon the inner side of each driving pulley is a two-lobed face cam, the shape of which corresponds to the relief upon the lips of the countersink. As the spindles approach the end of the feeding movement these cams contact with fixed rollers, mounted upon the frame of the machine, so that for the remaining distance of their advance the spindles take up a sharp vibratory movement endwise, the contour of the revolving cams following the stationary rollers under the impulse of the springs that form the fulcrums of the levers.

One Drill at Each Cycle

The result of this movement is that the machine turns out at each cycle a double end combination center drill and countersink that is completely formed as to diameter of drill, angle of the lips of the countersink, and relief; but as yet without flutes. The machines are entirely automatic, the operator having only to see that the hoppers are kept supplied with blanks and to inspect the product.

Not the least ingenious feature of these machines is the means of feeding oil to the tools. The oil passes through the hollow spindles which not only have a considerable endwise movement but, toward the end of each cycle, take up a rapid vibrating or reciprocating motion that would prove destructive to any ordinary means of connection. To absorb the vibration the spiral coil of copper tubing to be seen at the end of the machine is used to convey the oil to the spindles, the natural spring of the coil relieving the outer connection of any shock due to the movement.

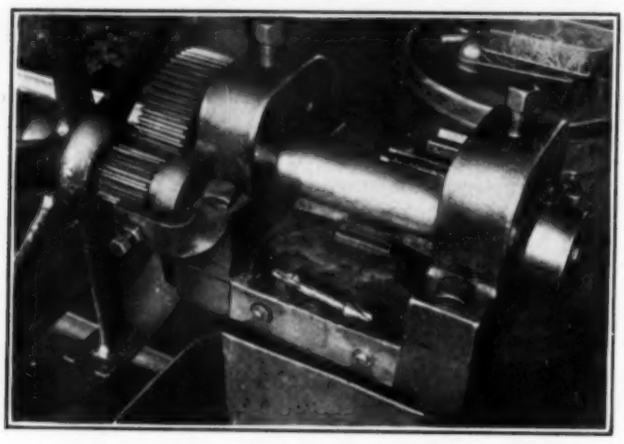


FIG. 4—STAMPING SIZE AND TRADE-MARK

After the turning operation the drills go to the special fluting machines, one of which may be seen in Fig. 3, where both flutes are cut at once. In this machine there are two spindles, each carrying a small fluting cutter, driven in opposite directions by open and crossed belts.

The heads carrying the cutter spindles are set at an angle complementary to the helix angle of the flutes and so located with reference to each other than one cutter is above and the other below the centerline of the work spindle. Once set to the correct angle and at the correct relative height for a given size of drill, the cutters have no further movement other than that of rotation. The drills to be fluted are held in a draw-in chuck at the end of the work spindle and as the latter advances endwise the drill passes between the cutters with a movement corresponding to the helix of the flutes.

The Work Spindle

The work spindle is in two parts, the outer member being a sleeve capable of rotation within the supporting bearing but having no endwise movement. It is rotated by the worm wheel and worm to feed the work to the cut. The inner member turns in a stationary cut of coarse pitch, corresponding in fact to the helix angle of the flutes, and is turned by the handwheel. Means

FIG. 5—POLISHING THE DRILLS

are provided for locking the inner and outer members together for the purpose of applying the power feed.

The bracket supporting the work spindle is mounted upon trunnions so that when the work is withdrawn from the cutters the spindle may be tilted to an angle of 45 or more degrees for convenience in unloading and reloading.

Because of the fact that the countersink portion of the drill is already relieved it is essential that the work be exactly placed in the chuck with reference to the threads that cause the advance of the spindle. In order to do this with certainty the operator is provided with a setting dog which he attaches to a drill in proper relation to the relief, and when he sets the drill in the

chuck the tail of the dog bears against a locating pin in the face of the spindle. As soon as the chuck is tightened the dog is removed.

The operator then swings the spindle to a horizontal position where it is held by a latch, turns the handwheel until the cutters come into action and locks in the feed. While the cutters are at work he has time to reset the dog on the next piece.

Each machine is manually operated and requires the sole attention of the operator. The operation is, however, quite rapid, and each fluting machine can take care of the product of two or more of the turning machines.

Following the fluting operation the drills are stamped with the maker's trademark and the size. The stamping machine is shown in Fig. 4. Contrary to usual prac-

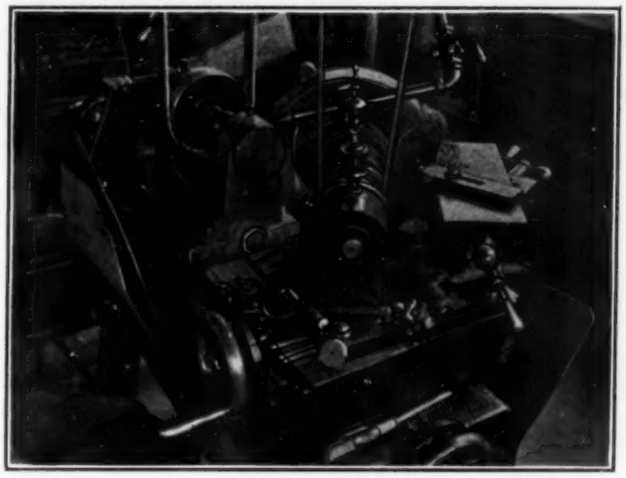


FIG. 6—GRINDING WITH A SET WHEEL

tice, the stamp is flat and is set in the bed of the machine while the work passes between it and a plain roll. This is possible only with a narrow stamp, but wherever it can be used it has the advantage that the work may be fed in as rapidly as the operator can handle it, and no effort or mechanism is necessary to synchronize the feeding with the revolutions of the roll.

Tempering and Polishing

The drills are heated for hardening in an electric furnace and tempered in oil baths in the usual manner, after which they go through a sand blasting operation to remove any scale and discoloration from the hardening, and from thence they go to the polishing machine shown in Fig. 5, which device consists primarily of two abrasive belts running in the same direction but at different speeds. The work rests upon a stationary steel bar set between the belts at a slight angle or inclination to the direction of their line of travel.

The operator has only to lay a drill on the projecting end of the rest and push it between the belts, when it will take up a slowly rotating movement and at the same time advance endwise exactly as if impelled by a screw. There is no screw, however. The movement is caused by the differential speed of the belts, and the rate of advance may be altered by merely changing the angle of inclination of the rest. Strange to say, the drills travel *up-hill*, both as regards gravity and the direction in which the belts are moving.

The next operation is grinding the cutting lips of the countersink and the diameter of the drill, done on

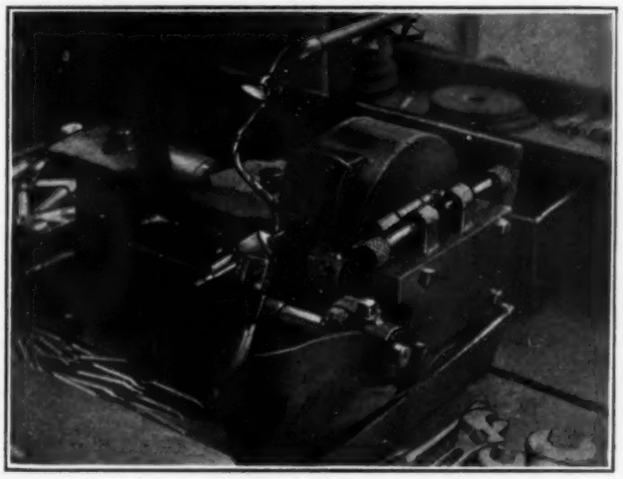


FIG. 7—SHARPENING THE DRILL POINTS

the machine shown in Fig. 6. A formed "set" wheel is used (that is, it has no traverse). The wheel head stands at an angle corresponding to that of the cutting lips of the countersink and about half of the wheel width is beveled off on a line that is nearly parallel with the centerline of the work. That portion of the wheel's periphery that remains parallel with its own centerline grinds the lips while the beveled portion grinds the diameter of the drill.

Drill Portion Tapered

The reason that the beveled portion of the wheel face is not made exactly parallel with the centerline of the work is because it is desired to make the drill portion of the tool slightly tapered, with the largest diameter at the point, for the sake of clearance. The wheel dressing slide-rest is permanently mounted at the back of the wheel, where it may be seen in the picture.

Redressing the wheel is a matter of but a few seconds, as it is necessary only to pass the diamond over the parallel portion of the periphery by turning the corresponding screw of the compound slide-rest, and over the beveled portion by turning the other screw. The diamond is always set.

As so far described, the reader is left in doubt as to how such a wheel can grind the necessary relief on the lips of the reamer. The answer is that the work spindle has an endwise vibratory movement, controlled by a cam, much like that of the corresponding parts of the turning machine except that it is in action all the time, and the rate of rotation is much slower. It is essential that the operator locate each piece in the chuck with exact reference to the flutes, and this is done by means of a gage that determines the position not only circumferentially but also the distance the tool projects from the chuck.

The only movement of the wheel head is in a direction at right angles to the centerline of the work spindle. This movement is obtained by the handwheel in front of the machine or by power feed. Ratchet feeds and positive sizing stops enable the operator to maintain accurate sizes.

The final machining operation is grinding the drill points, performed on the machine shown in Fig. 7, which works upon the same principle as the well-known forms of drill grinders. After passing through this operation the drills are completed and ready for the final inspection.

Inspection Methods in a Steel-Ball Factory

By Major Johnstone-Taylor
Shrewsbury, England

IN THE inspection of steel balls as used in ball bearings a good deal depends upon visual inspection and, in consequence, upon the skill of the viewers. Ample light and suitable surroundings are the first essentials. In the works of Ransome & Marles, a British concern whose business is the manufacture of small and moderate sized ball bearings of the highest class, the inspection is carried out by girls in a well lighted room.

The girls are seated at a table and each is provided with a light, shallow, rectangular tray, the surface of which is reflected in the undersides of the polished balls, rendering any defects in them visible to a trained eye. A momentary glance at the row of balls suffices, and they are then rolled about by motion of the tray so as to present fresh parts of their surfaces to inspection. When the whole of the surface has been examined and any defective balls picked out, the remaining balls are tipped into a box for gaging.

One of the defects which is detected by visual inspection is soft spots. They show up in a kind of brown cloudiness on the surface of the ball, but this marking is observable by the trained eye only. The softness is only relative to the glass-hard surface of the rest of the ball, but under the microscope file marks are visible upon these spots. The soft spots are generally seen to be minutely pitted and to lack the high polish of the harder part. In order to ensure the absolute cleanliness essential to proper inspection of steel balls, the viewers wear soft chamois leather gloves and also have cloths of similar material on which to place the balls, since any trace of grease makes examination impossible.

Obtaining Accuracy in Gaging

The average number of balls that can be inspected by a trained viewer in a day of eight hours is about 5,000, the average rejections per 1,000 balls in the works named being 12.3 for soft spots, 4.0 for cracks and 12.3 for serious defects. After visual inspection the balls go to the gaging room, which is kept at constant temperature. Every individual ball is passed through a ring gage, the makers guaranteeing accuracy within 0.0001 in. of standard size. The ring gage is set by a standard ball of known accuracy and the balls pushed through it, the viewer knowing by the sense of touch whether it is within the permissible limit of size. Those thrown out are again tested on a machine giving a magnified reading.

The methods of manufacture have been brought to such a high state of perfection that the actual variation is very much less than the guaranteed 0.0001 in. The balls are graded into a total of eight sizes intermediate between the limiting permissible sizes. The difference in size, therefore, between the balls of two successive groups is only 0.00002 in. and all the balls in one bearing are taken from the same group. Almost dead accuracy is therefore obtainable.

The grading is effected by the viewer placing all acceptable balls in one or other of three different heaps, according to the degree of ease with which they will pass the ring gage. There are thus three heaps, oversize, standard and undersize. The oversize and undersize are then passed again through ring gages, set to fractionally higher or lower sizes than standard. By a repetition of this process all of the balls are sorted into groups in sizes varying by about 0.00002 in., or one fifty-thousandth of one inch.

How Labor Can Be Made More Productive —Discussion

By Herbert D. Harper

The interesting report by Harold C. Smith of the educational activities of the National Metal Trades Association in Vol. 58, page 793 of the *American Machinist* contains a great amount of interesting information to those interested in training boys for industry.

His statements that less than 300 employers are training apprentices and that during the depression in business training activities were halted, would indicate that there is something radically wrong with industrial training in factories. It would seem that modern conditions have made the old system of apprenticeship impossible, and that some other institution must step in and train boys if the country is to have a supply of skilled workmen at all times. The youths of today will not consent to be bound out under contract for little or no pay as they did a century ago, and they rebel when it is attempted. In this they are right, for apprenticeship systems have not been efficient, and some have been more or less like slavery, or at least paternal.

Then, how many boys of the 700,000 mentioned by Mr. Smith had an opportunity to learn a trade? Can all the apprenticeship systems take care of them? For if any boy leaving grammar school who wanted to learn a trade did not have an opportunity to train, then industry has fallen down on the job and some other means must be provided. This training must not be halted whenever there happens to be a business depression, but should be continuous, so that every boy may have his chance to learn a trade. It must take the boy after his common school education is complete, and make him into a wage earner.

History shows us that when an institution becomes incapable of performing the functions for which it was created, society gathers up the neglected functions and assigns them to the public school, the one institution entirely under its control.

The only institution that has all the requirements for training boys in trade work is the public school, and where good trade schools are in operation they are a success. These schools give an industrial training that is more than an appendage to a liberal education, for the shops are real shops with conditions closely approximating those of industry. The school gives a more democratic form of training than the apprenticeship system, for it gives every boy a chance, with the least expenditure of time. The result will be that the school will supplant the apprenticeship system. There will be some confusion and maladjustments during the transition period, but with the co-operation of employers this disturbance can be made slight.

There are individuals who for personal profit would restrict the number of boys learning trades, and would keep the supply less than the demand. The school by proper vocational guidance would overcome this economic farce and see that enough boys are ready at all times to supply the demands of industry.

It Pays to Replace—

How a Shop Saved by Replacing Old Shop Equipment with New Equipment

These articles won honorable mention

By J. Howard Studholme
Master Mechanic, Thos. Wolstenholme Sons & Co., Inc., Philadelphia, Pa.

SOME time ago, I took charge of a repair shop that had been run in a slipshod manner for a number of years. The machinery throughout the plant was all patched up to keep it going and the store room contained nothing but junk.

The gears needed for repairs were all cast, and anyone who tries to run a series of such gears in train at high speed, knows the result of their use.

Among the equipment was a second-hand gear grinding machine, made about Noah's time—one of the kind where the gear was indexed by a pawl dropped between the teeth and the grinding wheel was dressed to approximately the shape of the teeth. This machine just about cleaned the sand off the teeth without making them uniform.

A great many studs of various kinds were used and, as they were all made on engine lathes from samples, they were not interchangeable.

Among other repair parts we had to make, were rollers with spiral grooves in them. These rollers we fluted on an old milling machine without a dividing head, by means of a plate having a slot on an angle to guide the work carrier by the movement of the table. The result was that the spirals were not correct and the rollers were continually breaking when in use.

As the shop had been run in this way for a number of years, it was difficult for me to make changes without encountering opposition. When I asked for new machines, the management wanted to know why the shop had run so many years without such a request from other foremen.

I told them they were losing money through loss of production in the mills by having machinery shut down waiting for replacements, and tried to convince them that the repair shop was the heart of the plant. After listening to the suggestions I made, they agreed to buy a Jones & Lamson flat-turret lathe.

This machine now takes care of all the stud work, relieving the other lathes. The work is all interchangeable, which is a great improvement over that made under the old method.

The president of the company saw the machine in operation and asked me how long it had been on the market. When I told him, he said they ought to have had one years ago.

The success of this machine established the confidence of the management in my judgment and resulted in the purchase of the following machines at various times:

1 24-in.x16-ft. Lodge & Shipley engine lathe.
1 16-in.x8-ft. Hendey engine lathe.
1 20-in. Cincinnati back-geared crank shaper.
1 No. 2½ Rockford milling machine with vertical milling and slotting attachments.
1 23-in. Snyder ball-bearing drilling machine.
1 4-ft. Carlton radial drilling machine.
1 14-in.x10-ft. Lodge & Shipley selective-head engine lathe.
1 30x30-in.x10-ft. double-head Whitcomb planer.
1 No. 0 Avey sensitive drilling machine.
1 No. B-2T Grand Rapids twist-drill grinding machine
1 No. 3 Oakley universal toolroom grinding machine.
1 No. 1 Diamond wet tool grinding machine.
1 Motor-driven United States tool grinding machine.
1 No. 4 Marvel high-speed hacksaw.
1 36-in. Brown & Sharpe gear cutting machine.

After retaining the best of the remaining tools, the shop is fairly up-to-date.

What is the result? Outside purchases are not necessary to keep the plant in operation and the storeroom is filled with interchangeable repair parts. I can now take care of all emergencies, make all cut gears and do not have to depend on the outside for anything. Besides all this, the plant, through fewer breakdowns, is able to produce more.

In addition to the regular work, the repair shop is now keeping in condition the following equipment belonging either to the company or some of its officials:

Automobiles, yacht engines, guns, moving picture machines and radio equipment. So, you see, it "Pays to Replace."

By John B. Walsh
Foreman Dept. G
Mergenthaler Linotype Co., Brooklyn, N. Y.

FOR a number of years the distribution screws on one model of linotype machines were finished by filing and polishing in a lathe.

These screws are 1⅛ in. in diameter and about 40 in. in length. While the thread is 2 per inch, the lands are about three times the width of the grooves, which leaves more surface to polish than that on a standard screw of the same pitch.

The finish on these screws must be good as they are to be nickel-plated and are exposed for the full width of the machine. Filing and polishing the screws took from 12 to 15 minutes each to do a good job and we had our own troubles to keep a man at such monotonous work.

About six years ago, I experimented on grinding the outside of the screws in the same lathe in which they were polished. An endless belt coated with abrasive was used, power being supplied by an electric motor held in the toolpost. While this method was an im-

provement over hand polishing, it was the best I could do without a cylindrical grinding machine, but the reduction in time was sufficient to have some of the screws sent to the grinding department, where they were finished on cylindrical grinding machines of the standard type. Until about three months ago all the screws were finished in the grinding department in 5 minutes each, as against 15 minutes in the lathe.

The company then bought a Heim centerless grinding machine and on this machine the screws are now finished in good shape at the rate of 63 per hour. The limits on the diameter are, +0.000, —0.001 inch.

As can be seen, the increase in production over the old method is nearly 1,600 per cent, while over the method of grinding on a machine using centers, it is more than 300 per cent. As the work is paid for by the piece and the prices have been adjusted accordingly, replacement showed a large profit.

By Wilson D. Mathewson
Gang Foreman, Brown-Lipe-Chapin plant, General Motors Co., Syracuse, N. Y.

WE MANUFACTURE automobile differentials, including ring gears and pinions.

Up to about seven years ago the ring gears and cases were machined on turret machines, of standard type. Since that time, we have installed twenty-two Bullard mult-au-matics of which eight of the first lot have been replaced by a later model.

We also make a little drive gear about 8¼ in. in diameter that we run in very large quantities. Our schedule calls for 28,000 for this month. Now if these gears were to be run on the old machine we used to have, it would cost for the first operation alone $0.0675 each. The cost on the mult-au-matic was $0.0100, which resulted in a saving of $0.0575 in this one operation. The saving on all operations together with the saving in overhead was $0.180 per piece, so that on 28,000 pieces, $5,040 represents the total saving.

We also make steel cases 12.375 in. in diameter, on which the cost of the first three operations was $0.5590, when done on the old machines.

The cost on the mult-au-matic was $0.1710, a saving of $0.5590 for the first three operations. The saving on all operations, including that of overhead, was about $1.75 per piece and, as the cases were made in lots of 1,000 a total saving of $1,750 was made.

As one man on the mult-au-matic can produce as much as five men on machines of older types, it goes to show that a saving of both men and floor space, by the use of improved machines, means a big saving in these times of high cost of labor and buildings.

By T. O. Giller
Gray & Davis, Inc., Cambridge, Mass.

UP TO eight months ago, we were turning armature shafts for starting motors and generators on ordinary lathes turning all bearings to grinding size, necking shoulders and chamfering ends. The price varied from $11 to $17 per hundred pieces, according to length, and three or four men were kept busy on this work nearly all the time.

By investing in a Reed-Practice rapid production lathe, we cut the cost of turning these shafts 50 per cent, and outside of the turning cost, the use of this machine has saved in both man power and floor space.

Book Reviews

Details of Typical Mechanisms. By C. M. Linley. Volume 31 of the Broadway Engineering Handbooks. Clothboard covers, 4¾x7½ in., 104 pages, 85 illustrations. Published by Scott, Greenwood & Son, London, England; distributed in America by the D. Van Nostrand Co., 8 Warren St., New York, N. Y. Price, $2 postpaid.

This little book is unique in some respects, partly because it aims to present the unique side and to explain the least understood points about the more common mechanisms. As the author himself states, the work is not intended to cover the whole subject of mechanical movements and mechanisms. Consequently, many forms of mechanical devices are not dealt with. Despite this fact, there is considerable valuable and interesting material for those interested in mechanism.

What the book does is to explain briefly the important features that should be known about the design and application of those mechanisms that are commonly employed in almost all classes of machinery. Rather than describe a mechanism as a whole, the author points out the difficulties that are likely to arise in connection with its use. Thus, the book is not primarily a textbook, but is best suited to the designer and the practical man to aid them in planning and operating machinery.

Naturally the treatment of each subject is brief, because of the size of the book, but the important points are covered. The material is divided into eleven chapters, which are well subdivided so as to make reference easy. The subjects treated are ratchets, clutches, variable-speed gears, toggle and universal joints, screws, brakes, reversing mechanisms, belt and chain drives, worm gears, stops and releasing mechanisms, and ball bearings.

A designer or mechanic would probably find the material of interest because of the unique phases presented. For example, under the subject of gearing are presented several arrangements of frictional and hydraulic gearing for speed variation, such as found in commercial mechanisms.

How to Think in Business. By Matthew Thompson McClure, Professor of Philosophy in the University of Illinois. One hundred seventy pages, 5x8 in. Published by the McGraw-Hill Book Co., Inc., 370 Seventh Ave., New York, N. Y. Price $2.

Any business man, busy or not, can find time to read this little book, and in doing so will see that his way of thinking has been a very important factor in his success. There will be few who do not find that Mr. McClure's explanation of how to think adds an improvement here and there that in the aggregate will be worth a great deal.

For the student, also, the book is admirably adapted, wherever emphasis is being placed upon directive and applied thinking. It need not interfere with the study of the theory of thinking.

The illustrative material has been drawn almost exclusively from the field of practical business experience, and the presentation is in a form which makes its suggestions readily and easily accessible.

Another good book for the business library.

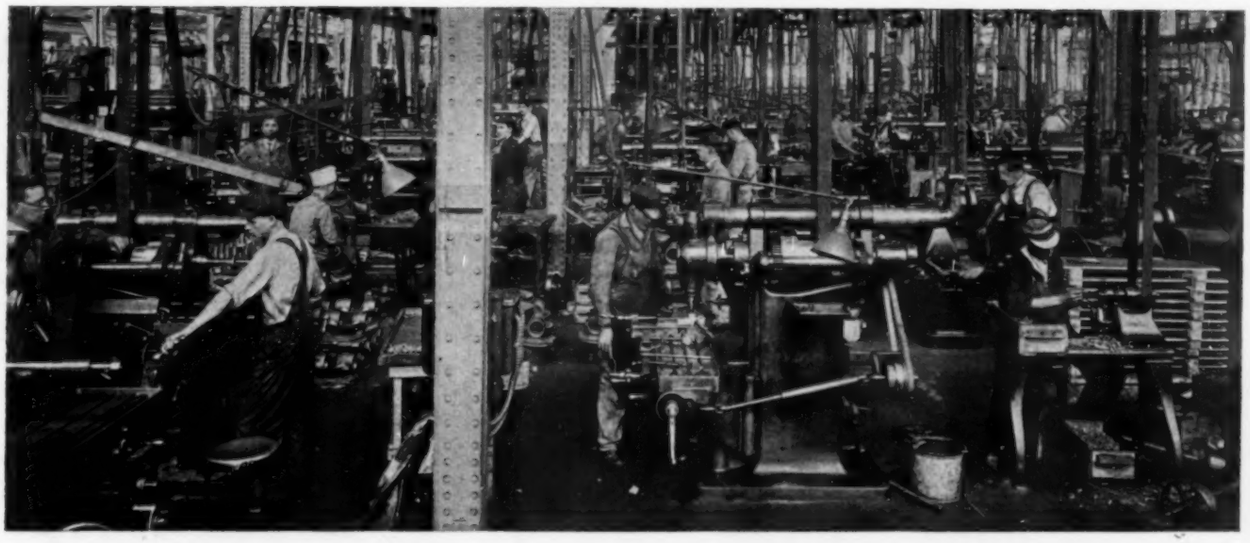
Where Machine Tools Are Made

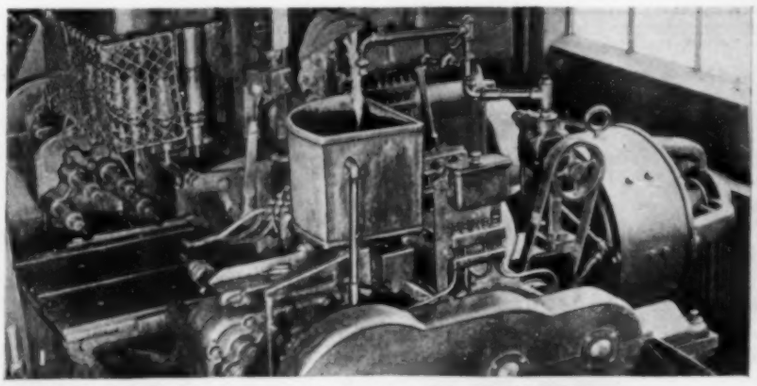
The Heald Machine Company

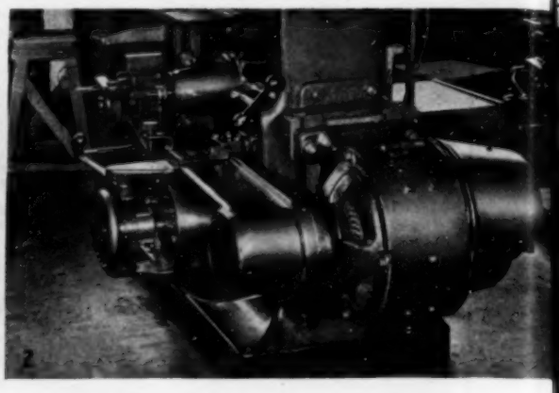
Established 1830

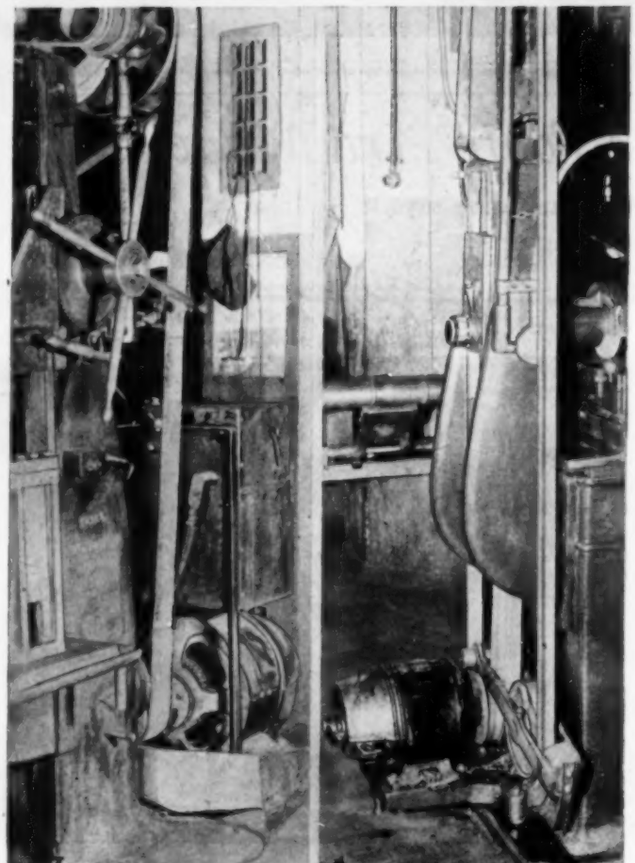
General View of Assembly Floor

General View of Machine Shop





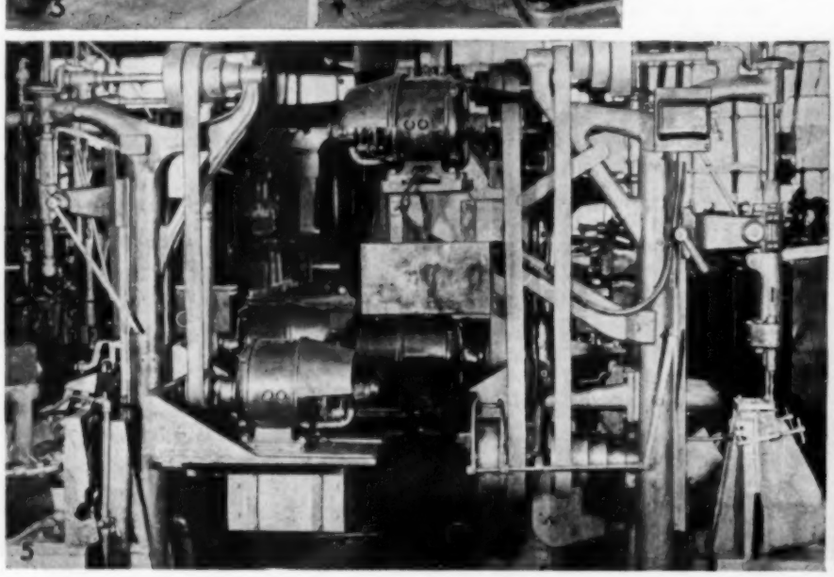


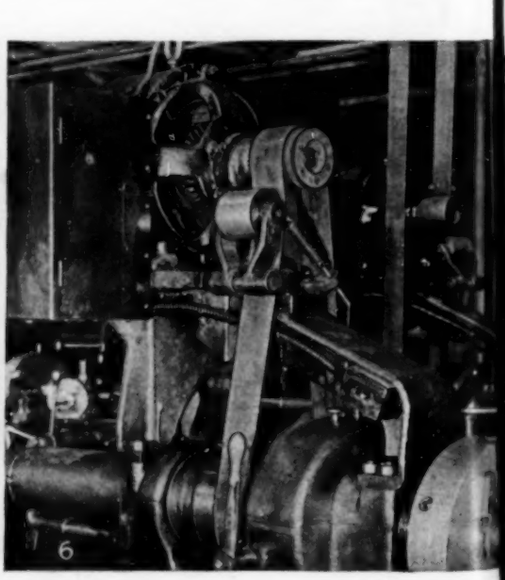


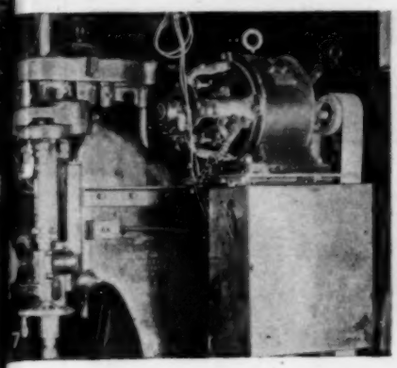
Changing 2,700 Machine Tools

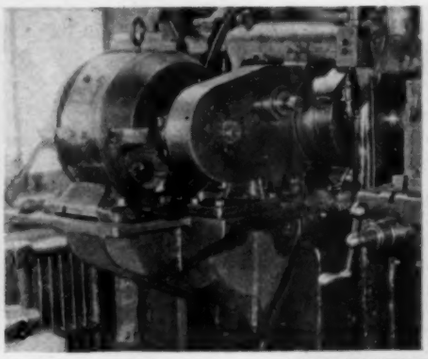
THE new plant of the Ford Motor Company of Canada, at Ford, Ontario, Can., has been planned for individual motor drive. In order to utilize as much of the present equipment as seemed advisable, motor drives have been installed on the machines before moving them to the new plant. This has required much ingenuity on the part of the engineers and the results are of unusual interest.

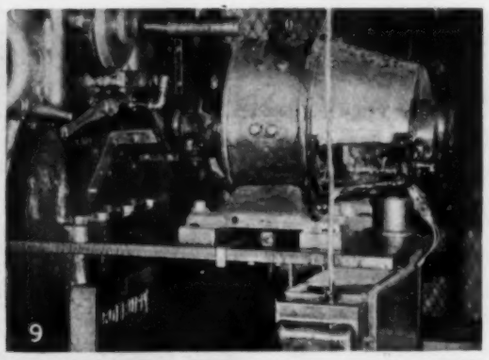
In some cases the cost of the motor drive attachment has been very high, owing to the lack of consideration of motors when the machine was designed. It is the belief of the engineers that the lowered cost of a building without provisions for line and countershafts will go a long way toward paying for the extra cost of motor driven machines. Current is generated in their own power plant at 4,600 volts a.c. and transferred to 230 volts d.c. for use in the motors. The motors range from ¼ to 75 hp., the average being from 3 to 5 hp., these being built by the Canadian Westinghouse Co. at its plant in Hamilton.











to Individual Motor Drive

Fig. 1—Three way, 25 spindle, cylinder tapping machine direct driven with 10 hp. reversing motor. Clutches replaced with full automatic electrical control. Operation highly satisfactory and a saving of over 25 per cent in tap breakage.

Fig. 2—Tool room shapers. Cone replaced with clutch and sprocket using chain drive to variable speed motor, 400 to 1600 r.p.m.

Fig. 3—Special 15 spindle drill for bolt holes in cylinder heads. Only one speed required.

Fig. 4—Surface grinder. Large pulley is at top of machine.

Fig. 5—Two types of brackets for 20 in. drills. One arranged for variety of speeds.

Fig. 6—Screw machine motor bracket held by bearing cap bolts.

Fig. 7—Two heavy duty drills for drilling drop forged transmission parts. Motor bracket made of boiler plate and angles.

Fig. 8—Cone drive miller using constant speed motors on production work and variable speed motors 450 to 1800 r.p.m. when machines are for general work.

Fig. 9—Heavy duty drill press. Motor support made by inserting boiler plate between sections of machine frame.

Fig. 10—Direct drive for lathe. Lever operates clutch and brake.

Fig. 11—Chain drive on manufacturing miller. Motor plate built up from structural steel shapes.

Fig. 12—Four spindle drill.

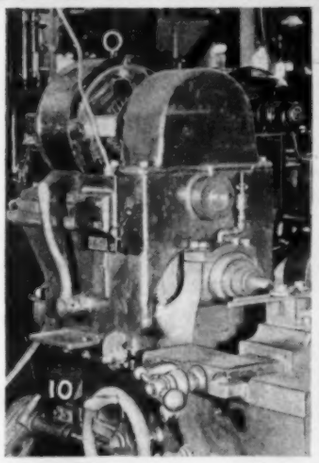
Fig. 13—Radial drill on die work. Motor plate mounted over change gear box.

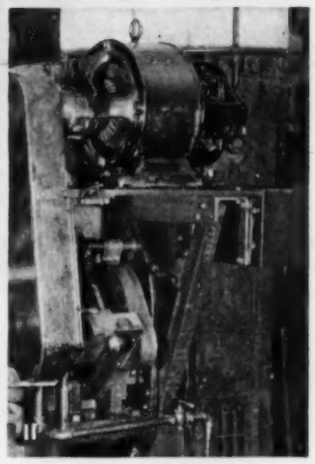
Fig. 14—Double end centering and drilling machines arranged in this way.

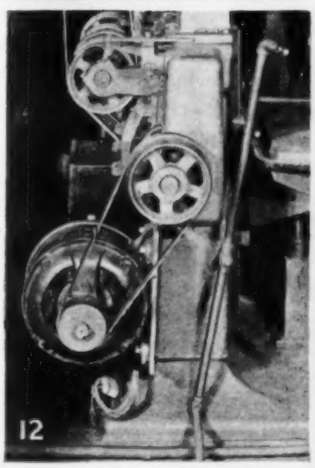
Fig. 15—Special crank shaft lathe. Motor plate carried on long bars which take the place of bearing cap bolts.

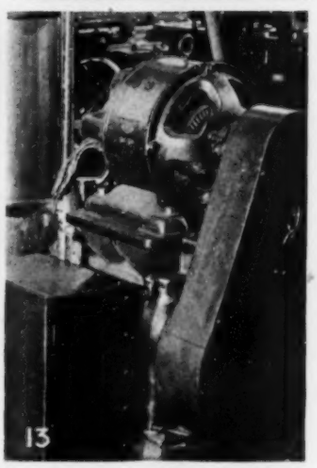
Fig. 16—Power press for forcing bevel gear on axle shafts.

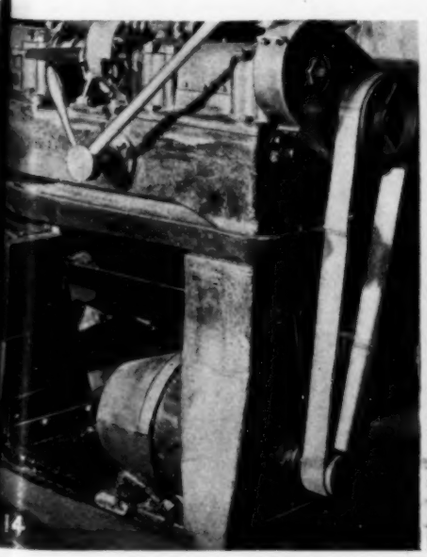
Fig. 17—Two types of drives on large drawing presses.

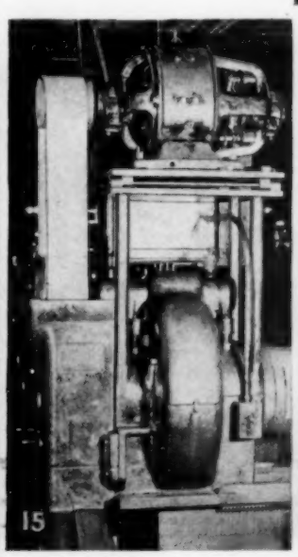


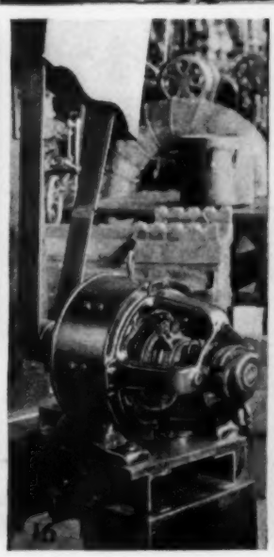


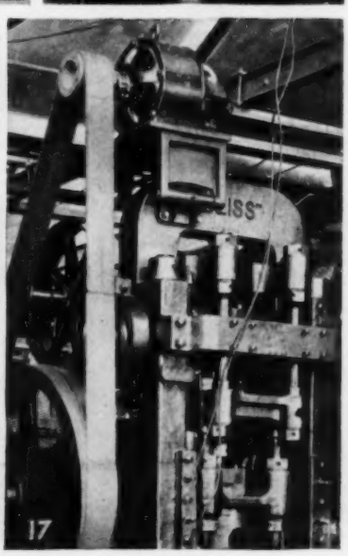


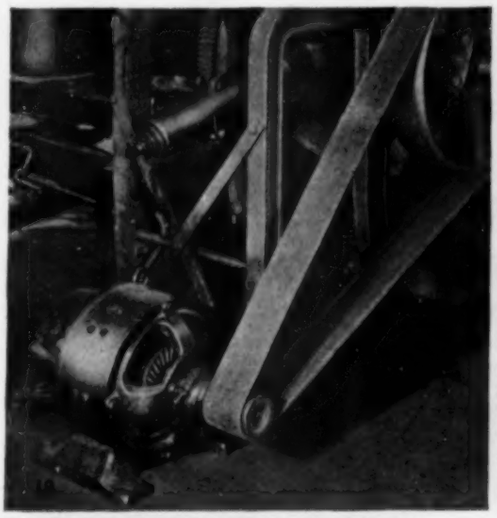


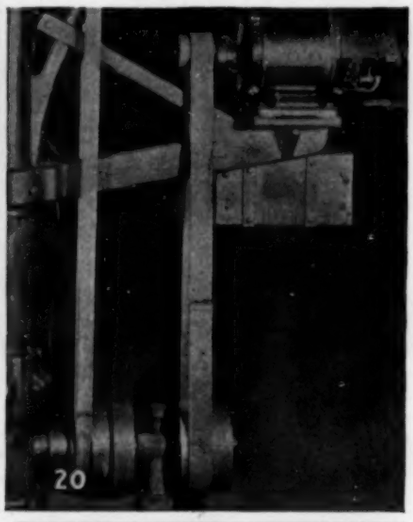


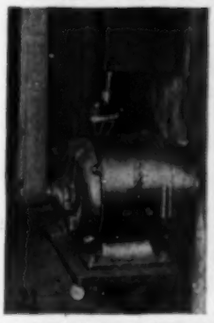


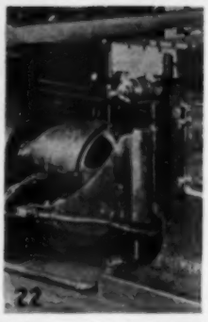


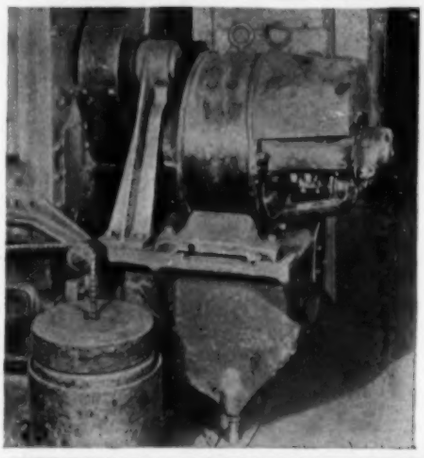












Changing 2,700 Machine Tools to Individual Motor Drive

(Continued)

Fig. 18—Tumbling barrel drive.

Fig. 19—Large surface grinders on die work.

Fig. 20—Drill press with tapping head. This arrangement of motor drive used where variety of speeds is required.

Fig. 21—Rear view of screw shaver, roughing heads of valves.

Fig. 22—Direct driven milling machines milling square on drive shaft.

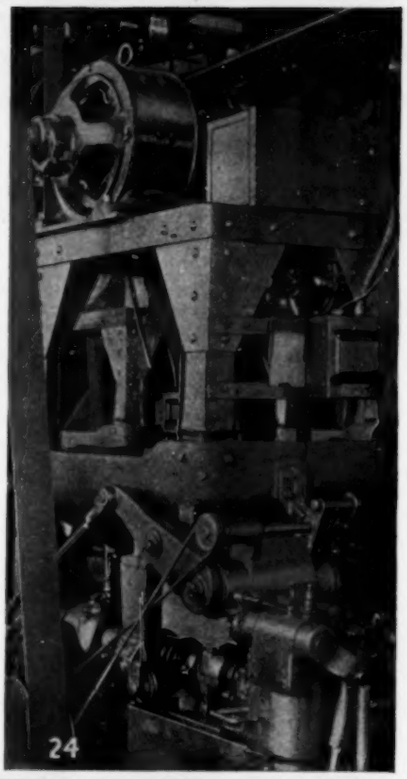
Fig. 23—Rear view showing 15 hp. motor on 4 way 45 spindle drill for cylinders.

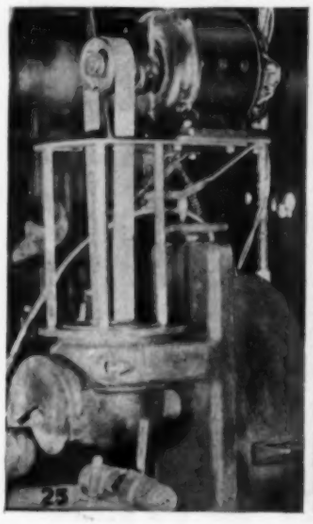
Fig. 24—Double spindle automatic threading machines. Motor bracket mounted on top of hopper.

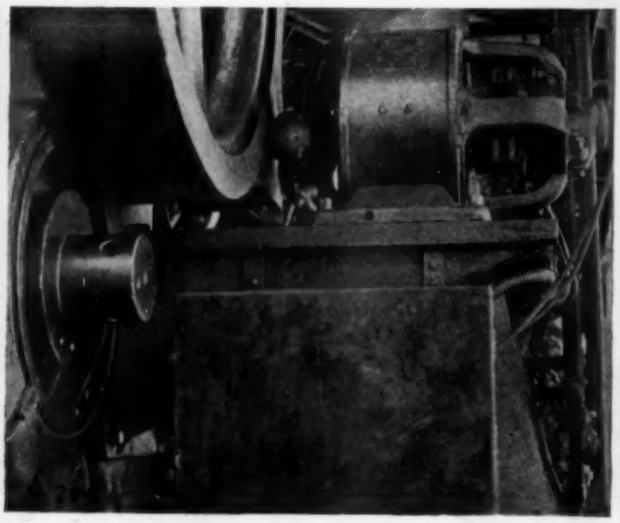
Fig. 25—Hob grinder with motor mounted so that it will swing with head to any angle.

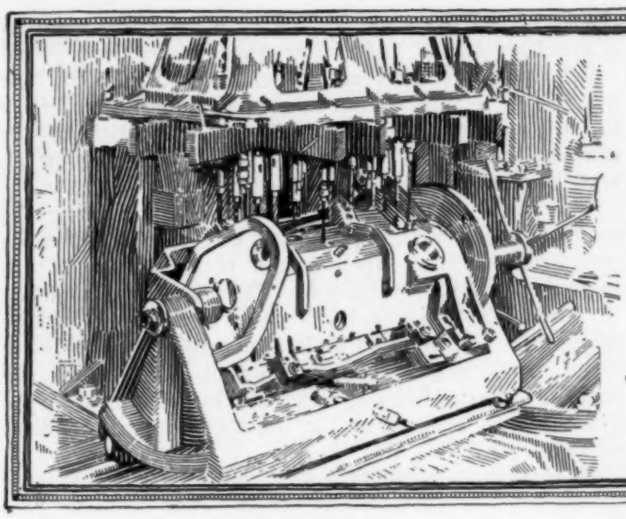
Fig. 26—Large press with toggle joint action. Tight and loose pulleys removed and fly wheel cut for motor gear; 90 per cent of the punch presses were equipped by gearing into fly wheel.

Fig. 27—Very satisfactory drive for tool room lathes.









Tool Engineering

By
Albert A. Dowd and Frank W. Curtis
President and Chief Engineer
Dowd Engineering Company, New York City

Inspection and indicating gages continued—Miscellaneous gaging problems—Taper gage with dial—Indicating keyway gages—Fixture for testing backlash of gears

THERE are a number of problems which require solution when designing gages, and many of them cannot properly be classified except under a "miscellaneous" heading. Occasionally gages which may be a combination of inspection and work gages are required, and in many instances the same type of gage is used by the workman when producing the work that is later used by the inspector in the final inspection. We have previously mentioned a few of the important points which enter into the design of gages for tapered work, both external and internal. The importance of the diameter at the large end of the taper has been emphasized, and we believe that the tool engineer realizes its importance.

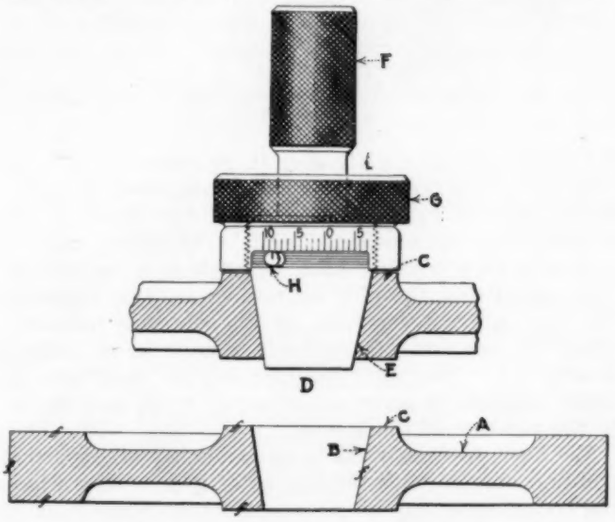


FIG. 557—TAPER GAGE WITH DIAL

In the example shown in Fig. 557 the work *A* is a casting which has been machined on the surfaces marked *f*. The tapered portion *B* must be so made that it bears a close relation to the finished boss *C*, in order that the work may draw back on to a tapered shaft and at the same time not strike against the shoulder on the shaft. In order to make sure that the diameter at the large end of the taper is not too great and at the same time to determine whether it is within the limits of accuracy desired, a special gage like that shown at *D* may be used to advantage. In this case it must be remembered that the angularity of the taper is not in question, as this feature should have been tested previously.

The gage shown at *D* consists of a tapered plug *E* which enters the hole as shown. The plug is made with a knurled handle *F* and a knurled collar *G* which is threaded on to the body. The plug *E* has in it an inserted plug *H* as shown, and on this small plug a line is scribed. The threaded collar is cut away and graduated with a series of lines and numbers in order to give the inspector a chance to see how much variation there is in the relation of the taper to the boss. In using this instrument the collar *G* is loosened and the plug

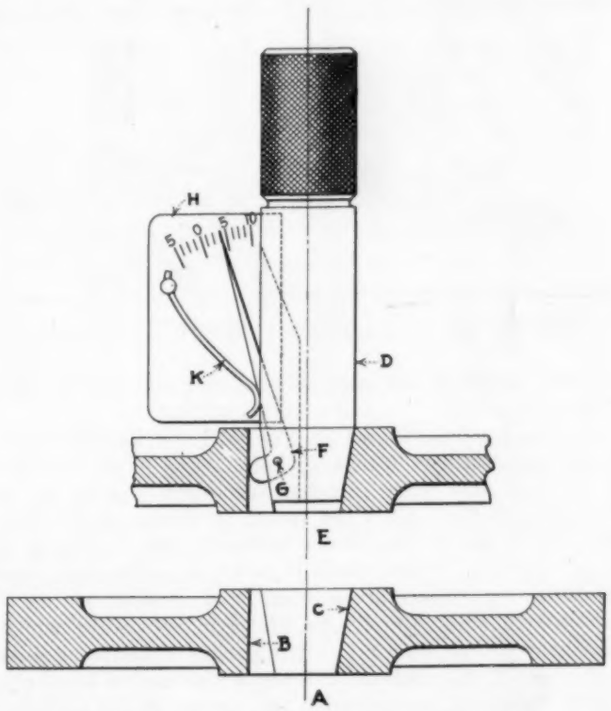


FIG. 558—INDICATING GAGE FOR KEYWAY

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inserted in the hole, after which the inspector turns the graduated collar until it makes contact against the surface *C*. At this time a reference to the position of the graduations with respect to the line on the plug *H* will immediately show whether the hole and boss are in the correct position or not. If incorrect, the amount of variation can be easily noted by the difference in the position above or below the zero mark.

The depth of a keyway is occasionally an important matter, and it is not always easy to gage it by ordinary methods. This is particularly the case when the keyway is straight and located in a tapered hole. It is, of course, always necessary to make sure that the taper itself has been previously gaged before attempting to use the keyway gage in the hole, as variations

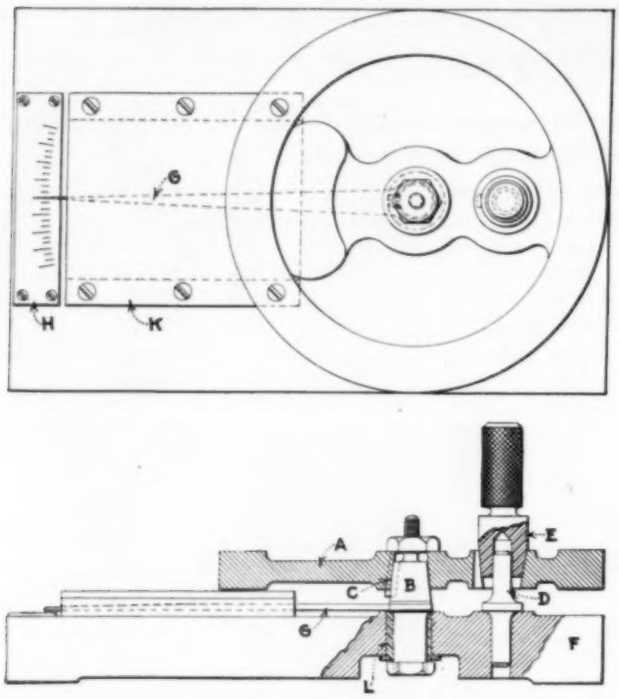


FIG. 559—KEYWAY GAGE FOR MOTOR FLYWHEEL

in the taper would cause incorrect reading at the indicator point.

In the work *A* shown in Fig. 558 the keyway *B* is to be gaged from the tapered hole *C*, and in order to do it quickly and with sufficient accuracy a plug *D* is designed so that it fits the taper, as shown at *E*. The plug is slotted to receive the indicator arm *F*, which is pivoted at *G*. A steel plate *H* is set into the plug gage as shown, and there are a number of graduations on it which will show the limits of accuracy within which the keyway has been cut. The spring *K* bears against the side of the indicator lever *F*, so as to keep the latter always in contact with the bottom of the keyway.

It is important that the thickness of the lever should be considerably less than the width of the keyway, so that it will not be affected by burrs in the corner of the keyway. It will be seen that any variation from the correct depth will be clearly shown by fluctuations of the indicator point with respect to the zero mark. This type of gage can be used for either work or inspection.

In a motor flywheel of the type used on small motorcycle engines the position of the hole which carries the crankpin is important in relation to the keyway in the center of the flywheel. In order to gage this relation a special form of indicating gage is required. One which has proved successful is shown in Fig. 559. The flywheel *A* is mounted on a tapered plug *B* in which a key *C* is carefully located. The other location of the flywheel is obtained by means of a straight plug *D*, which enters the crankpin hole but does not fit it.

The fit is obtained by placing the plug *E* over the portion *D*, and pressing the plug down until it "makes up" firmly in the taper. Both plugs *B* and *D* are located in a cast-iron base *F*. The plug *B* has attached to it directly opposite the keyway a pointer *G*, which moves over a graduated scale *H* according to the variations in the keyway. Any errors in the location are multiplied several times, according to the length of the pointer with respect to the distance from the center of the keyway.

In making gages of this sort where a delicate pointer is used, it is advisable to protect the pointer from

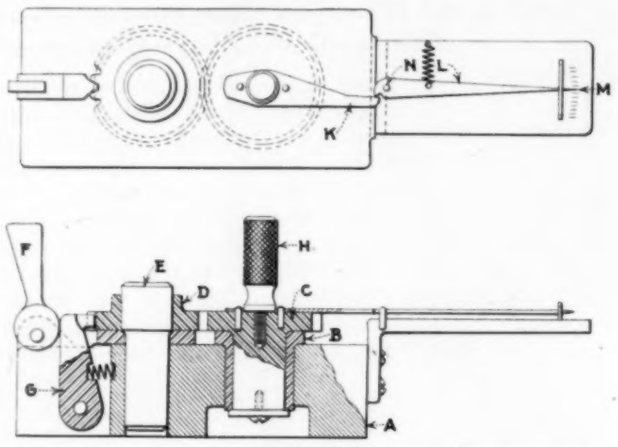


FIG. 560—GEAR TESTING FIXTURE FOR DETERMINING LOST MOTION

injury by putting a plate over it, as shown at *K*. The only portion of the pointer which is unprotected is that which extends beyond the edge of the plate *K* and travels over the graduated dial. The center plug *B* is located in a bushing *L*, in which it is a running fit, thus permitting the plug to revolve freely. Gages of this type are not common, but they become necessary when the position of the keyway must be accurately determined. The multiplication of the lever can be made sufficient to show variations as small as 0.001 in. in the position of the keyway.

We have previously taken up a number of important points connected with the gaging of gears, but we have not considered anything except work gages. It is evident that various points connected with the manufacture can be looked into during the process; and while the limits can be held very closely, it may be found that after the gears have been hardened, and also from other causes, certain changes have taken place which can be found only by careful inspection. For this reason we must consider not only the limits within which the work has been manufactured, but also the effect of errors in manufacture in the running of the gears. Inspection fixtures for determining whether the gears have been correctly cut and whether they will run together smoothly are of great importance, and their principles should be carefully studied before the design is attempted.

If gears are cut too deeply or if their pitch diam-

eters are not correct, there will be a certain amount of lost motion between the teeth when two gears are in mesh. The ordinary method of testing gears to determine whether or not there is too much lost motion or back-lash is to place both gears on studs, and the operator then determines by the "feeling" whether they are too loose or too tight. This method is dependent largely upon the judgment of the operator, and in order to obviate the personal element the fixture shown in Fig. 560 was designed.

The base of the fixture *A* is of cast iron, and it is provided with a bushing *B* in which a master gear *C* revolves. The gear which is to be tested is shown at *D*, and it is placed in position on the stud *E*, which is made small enough to allow the gear to move freely on it. After the gear has been placed in position the cam lever *F* is thrown over, and the pawl *G* is forced in between the teeth to hold the gear rigidly in place.

After this has been done the operator takes the knurled handle *H* between his fingers and tries to turn the master gear in both directions. The master gear *C* has on it a lever *K*, which bears against the end of the indicator *L*. If there is any shake between the teeth of the master gear and of the one which is being tested, the error will be multiplied by the pointer *L*, which will immediately show the amount of error by its fluctuations on the graduated scale *M*. The amount of multiplication can be controlled by the lengths of the levers *L* and *K* and by the position of the fulcrum pin *N*.

This is a very simple type of fixture and it is economical in its construction. There would be no great expense involved in the building of it, and by the addition of certain refinements it could be so made that several gears of different sizes could be tested in the same fixture. It would be necessary only to make the center distance adjustable and to provide the master gears to suit conditions.

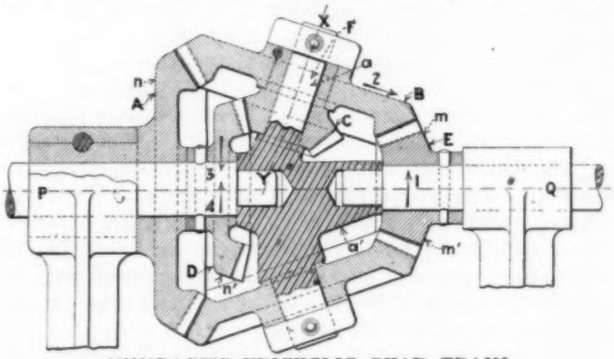
A Problem in Epicyclic Gearing—Discussion

BY F. E. BARDROF

THE analysis of the epicyclic gear train by Mr. De Leeuw on page 283, Vol. 58, of the *American Machinist* is interesting, both on account of the labor the author uses and because his solution of the problem is not correct. This is not a new gear by any means, being strictly similar to the so-called Humpage's gear which is described and analyzed in almost every text book on kinematics.

In the first place, there is a typographical error in the statement of the problem, as *A* should be *D* in the third line of the second paragraph. It is evident that the ratio between *E* and *D* is desired.

It seems to me that the solution goes wrong when the



HUMPAGE'S EPICYCLIC GEAR TRAIN

writer makes the following statement in the second column of the article: "Gear *E* also causes gear *B* to move around the axis *XY*. The amount of this movement will be $\frac{E}{B}$ revolutions."

The rotation of *B* about its axis is not caused primarily and simply by gear *E*. It is evident that if the part carrying the pin *XY*, which I will hereafter designate as the arm *F*, is held stationary neither *E* nor *B* can revolve, and therefore the rotation of *B* about *XY* is found by an analysis of the motion of the arm F. If the arm is revolved once about the axis *PQ* in the direction of arrow No. 1, *B* will make $\frac{A}{B}$ turns about *XY*.

Since one revolution of *E* causes the arm *F* to make $\frac{E}{E+A}$ turns about *PQ*, the number of turns of *B* about *XY* for one turn of *E* will be

$$\frac{A}{B} \times \frac{E}{E+A} = \frac{B(E+A)}{AE},$$

instead of $\frac{E}{B}$ as given in the solution under discussion.

Substituting this value in the analysis for gear *D*, we find that the number of revolutions of *D* for one revolution of *E* will be

$$-\left(\frac{AE}{B(E+A)} \times \frac{C}{D}\right) + \frac{E}{E+A},$$

or, with numerical values,

$$-\frac{48 \times 21 \times 18}{42 \times 69 \times 30} + \frac{21}{69} = 0.0956$$

Therefore, 100 revolutions of *E* will cause *D* to make

$$100 \times 0.0956 = 9.56 \text{ revolutions.}$$

A much simpler solution of the problem may be made be the use of the tabular system. This system has two steps:

(1) Hold the arm still and rotate one gear, finding the revolutions of the others;

(2) Revolve the whole train in such a manner as to bring the fixed member back to its original position.

In this problem let us consider the arm *F* and the gears *E*, *D* and *A*.

	F	*E*	*D*	*A*
1st step	0	$-\frac{48}{21} = -\frac{16}{7}$	$\frac{48}{42} \times \frac{18}{30} = \frac{24}{35}$	1
2nd step	—1	—1	—1	—1
	—1	$-1-\frac{16}{7} = -\frac{23}{7}$	$-1+\frac{24}{35} = -\frac{11}{35}$	0

As an explanation of the table, in the first step *F* is held stationary and *A* is given one turn in direction No. 1. By tooth ratios the number of turns of *E* and *D* are readily found, as shown, being careful of signs. In the second step the whole train is revolved in the opposite direction, in order to bring *A* back to its original or fixed position. By addition we find that one revolution of *F* in the negative direction will give *E* $\frac{23}{7}$

turns and D_{35} turns in the same direction. The ratio between E and D is, therefore,

$$\frac{11}{35} \times \frac{7}{23} = \frac{11}{115} = 0.0956$$

which checks with the result just obtained by the method employed in Mr. De Leeuw's solution.

Another good method for solving epicyclic trains is by a formula derived from the above. I am indebted to Mr. L. F. Moody for this formula, which I have found very useful. I will not take time to give the derivation, which is comparatively simple.

$$e = \frac{n - a}{m - a} \qquad (1)$$

e = value of train with the arm fixed.
n = turns of last wheel.
m = turns of first wheel.
a = turns of arm.

The wheel at either end of the train may be called the "last" when $e = \frac{\text{turns of last}}{\text{turns of first}}$, and if direction signs are properly used.

In this solution the gearing must be split up into its component parts. It is evident that there are two simple epicyclic trains, one of which drives the arm and the other gear D. The first step is to imagine that the gears C and D are removed, leaving the epicyclic driving the arm. Then, referring to the illustration for the meaning of the letters,

$m = 1$, $n = 0$, and $a = ?$

$$e(\text{arm fixed}) = -\frac{E}{A} = -\frac{21}{48}$$

Substituting in (1),

$$-\frac{21}{48} = \frac{0 - a}{1 - a}.$$

$$a = \frac{21}{69}. \left(\text{This value is } \frac{E}{E + A}\right)$$

The second step is to suppose that the gear A is removed, leaving the epicyclic driving D, and then give the arm the number of turns found above.

$$m' = m = 1,\ n' = ?,\ a' = a = \frac{21}{69}.$$

$$e(\text{arm fixed}) = -\frac{E \times C}{B \times D} = -\frac{21 \times 18}{42 \times 30} = -\frac{3}{10}$$

Substituting in (1),

$$-\frac{3}{10} = \frac{n - \frac{21}{69}}{1 - \frac{21}{69}}$$

$n = 0.0956$ revolutions of D for one of E.

The gear ratio of Humpage's gear as generally used is higher than the gear in question due to different tooth ratios. If the numbers of teeth on the gears were E, 12; B, 42; A, 48; C, 16; and D, 18, it would take 315 turns of E to produce one revolution of D in the opposite direction.

The Status of Tool Designers

By Herbert W. Cable

THE time is coming when a change in the policy of some manufacturers toward tool and machine designers will be necessary. This will be due to pronounced shortage of capable men and an increased cost of special tools.

Some years ago it was thought necessary, when tools were needed, to employ a highly skilled mechanic at a good salary to develop the necessary equipment. The attraction of the substantial pay and white collar job offered an opportunity for correspondence schools, and night schools, to induce thousands of young men to study for the better job.

The war caused an increased demand for tool designers and almost anyone who could push a pencil called himself a tool designer. In order to get work of any value from these men, a close and direct supervision was necessary. This gave rise to the leader, or squad, system which was costly inasmuch as it required a large number of non-producing straw bosses. These straw bosses were generally picked from the best men in the department but their ability was not always high and their leadership frequently resulted in delay and inefficiency.

The poor quality of work, the large number of costly errors and the demand for high wages of men who had a good flow of language, but were lacking in mechanical knowledge, has shaken the confidence of the shop managers. As a result the remuneration for even the best of designers is below what is fair and necessary or proper. Other trades, in which the amount of training and experience is far less than that of tool designers, but in which the men are organized, are paying nearly twice as much.

It takes a man of intelligence and resourcefulness to make a good designer and this class, finding it impossible to make a good living as draftsmen, are rapidly going into other lines of business. This leaves the mediocre men, who are contented if they can just hold the job at a comparatively low salary, regardless of the cost to the company of their errors and poor quality work. This also has enabled department heads to make the payroll look small, while they are able to cover up with diplomacy the losses due to changes in design. A poorly designed tool will prove costly in the efforts of the shop to get it to work, in alterations necessary, in decreased production and poor quality.

It behooves the manufacturers, while there are still a few good men in the business, to offer higher salaries and better working conditions to make it worth while for the ambitious and progressive man to remain a designer. The manufacturer should demand increased efficiency and high grade work, judging men by their actual ability. A basis for value can be found in the increased production of new tools, the cost of getting the tool to operate after it is in the shop, and the quality of the pieces or work turned out.

High salaries are paid to big league ball players, but only the highest type of player is able to stay on the team. The same should apply to tool designers, a demand for first class work and the proper encouragement in the way of remuneration. A few good men will do more and better work than a whole roomful of pencil pushers and the sooner the manufacturers see the losses in the shop, and are not blinded by the apparent low cost of designing, the better conditions will be. There is no other line where ability is of more value.

A doctor can sometimes cure a patient of an imaginary illness by cheerful words and chalk pills but it takes real medicine and real action to handle a diseased condition. In these days of keen competition, it is up to the manufacturer to keep his organization healthy and he will need real ability in his employees to keep it so.

Some Details of Lathe Design

By ALBERT CLEGG

Push pin lock for heavy machinery—Double back gears — Cone clutches applied to feed-starting devices—Reducing the friction in a powerful clutch

THE SERIES OF articles published in the *American Machinist* on "Methods of Machine Tool Design," by A. L. De Leeuw, are worthy of the highest appreciation from all sections of the machine tool trade, and should eventually attain to the dignity of a machine tool classic, as Unwin's "Elements of Machine Design" and several other important works have done in connection with general engineering practice. One does not need to read far in any of these articles to be convinced of the fact that the author is an intensely practical man who has very little to learn concerning the design of machine tools. Because of this conviction, the present writer is rather diffident in pointing out what he considers are omissions on the part of Mr. De Leeuw, and he does so with the single object of helping to make the series more complete and more up-to-date even than it is at present. These suggestions, however, are made in no spirit of destructive criticism, but with the best of intentions and also with a note of the deepest appreciation for Mr. De Leeuw's efforts up to the present.

With reference first of all, to the chapter beginning with page 287, Vol. 57, and dealing with the design of lathe back gears, I cannot understand Mr. De Leeuw's reference to the push pin lock for connecting the cone to the spindle gear as being useful for light machinery only. It seems to me that the diameter of the pin can

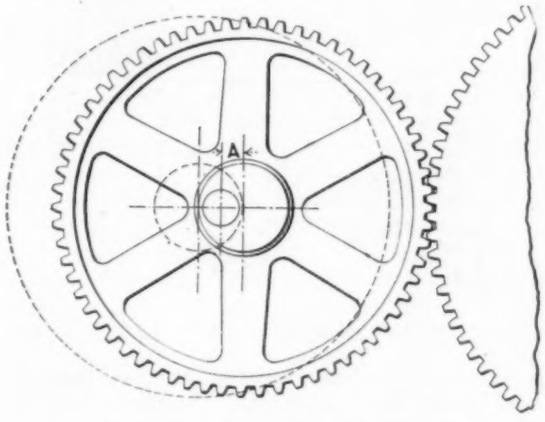


FIG. 1—ECCENTRIC SHAFT DESIGN

be made as large as is required to suit the heaviest conditions. I have used it on 36-in. lathes having belts up to 6 in. wide, but apart from this, there seems no real reason why the pin method should not be in every way as strong as the bolt and nut method. There can, of course, be no doubt as to the handiness of the two arrangements, one operated by the fingers and the other requiring the use of a spanner. It must be remembered that the pin is only subjected to the pressure from the open belt; that is to say, when the back gears are in use, the pin is inoperative and under no load whatever. Such being the case it is improbable that the load on the pin will ever exceed three or four hundred pounds even in the largest lathe, and there should be no difficulty in designing a circular push pin or

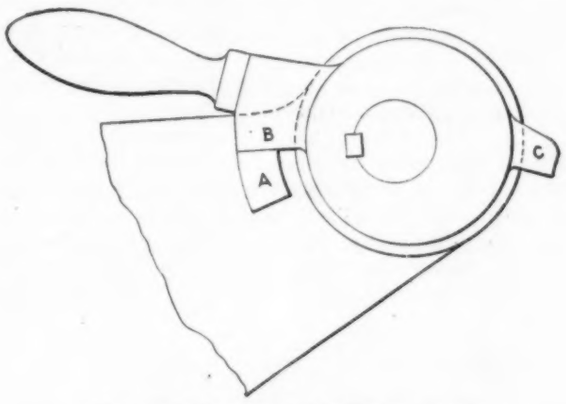


FIG. 2—STOP FOR ECCENTRIC SHAFT

plunger, easily able to negotiate a load of this magnitude.

Further, in dealing with the eccentric shaft, it is stated that the throw, that is, the distance from the fixed center of the eccentric shaft to the movable center, will need to be $\frac{3}{4}$ in. for a 3-pitch gear. With reference to Fig. 1 the $\frac{3}{4}$-in. throw relates to dimension *A*. Now such a large throw as this is obviously unnecessary unless it is required to move the operating handle of the eccentric through not more than 90 deg. It is quite evident that the maximum possible movement of anything mounted on an eccentric is always equal to twice the throw. The stroke of an engine is twice the throw of the crank and the same holds good with an eccentric.

With this modification—and I have never yet seen a lathe in which the eccentric shaft handle did not move through practically 180 deg.—Mr. De Leeuw's analysis of the various elements of the eccentric shaft will require some overhauling. It will not be necessary to have the body of the shaft anything like $3\frac{1}{2}$ in. in diameter, in order to provide for the location of the two sets of center holes.

With reference to the stop and locking device shown in Mr. De Leeuw's Fig. 115, an exactly similar idea,

as shown here in Fig. 2, can be used for the heaviest class of machines. Instead of the concealed pins as used in his method, there is a stop *A* cast or fixed to the headstock against which abut two lugs *B* and *C* on the eccentric shaft handle. I quite agree that some form of clamping screw is desirable. The forces tending to throw the gears out of mesh are so nearly equal to those tending to hold them in, that the gears are more or less in a state of unstable equilibrium and liable to be thrown out by any sudden fluctuation of the cut. It should be noted that while the reaction from the front pair of gears is tending to hold the eccentric shaft in the "in-gear" position, the cone pinion and its gear are exerting a smaller force which is tending to throw the eccentric shaft out. Further, the friction of the quill on the eccentric shaft has a tendency to disengage the gears. This tendency is neutralized by the friction of the eccentric shaft in its bearings in the headstock. It is comparatively easy to analyze the forces acting on the shaft, but it is not so easy to calculate their intensity, and since they so nearly balance each other, it is safest to provide some simple form of clamp to take care of any temporary abnormal condition.

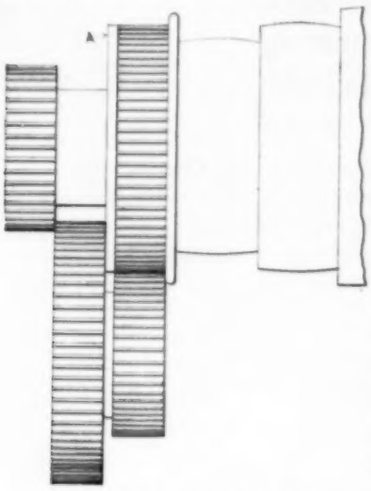


FIG. 3—NON-INTERFERING DOUBLE BACK GEARS

A Correction for Double Back Gears

Just a couple of points about double back gears. Mr. De Leeuw points out that it is not very easy to obtain a high gear ratio—on the face of it, it seems rather strange that for a given range of speeds a higher gear ratio is required with double back gears than with the ordinary type—or a wide range of speeds with double back gears. This fact is quite true, but the ratio can be slightly increased and the running qualities and strength of the gears, improved by the use of corrected addenda for both the gears and pinions. In effect, this fact merely means that the pinions are cut with a tooth less than the blank is sized for and the gears a tooth more. The cutting of the teeth, however, must be by the generating process and not by formed cutters unless the cutters have been specially made for the particular job. Now reducing the number of teeth in the pinions and increasing the number of teeth in the gears, obviously gives a slightly higher gear ratio. This ratio in turn will allow a wider range of speeds. But it also gives a shape of tooth for the pinions which is 20 to 30 per cent stronger than a standard tooth, and in addition, by lengthening the arc of action, will result in smoother running, and greater durability.

When the twin sliding gear on the quill of a double back-geared lathe is moved across from one position to the other, there is always a possibility that it might not be moved the full distance, the result being that both pairs of gears would be in mesh when the eccentric shaft was thrown in. This condition could quite easily result in a serious smash if an attempt were made to start up the machine.

To overcome any such possibility, the simple device shown in Fig. 3 has always been used by the writer when designing this type of gear. A plate *A* is fixed to the larger of the cone pinions, whose outside diameter it equals. The sliding gears have a space between them to accommodate the plate as shown. When the gears are moved, the eccentric shaft cannot be engaged if they have not been moved the full amount. They must be in either the extreme left or extreme right position, otherwise the plate *A* interferes with the outside diameter of the smaller sliding gear, and prevents the engagement of either of the gears. Similarly, it is not possible to slide the gears until they have first been thrown out of mesh by the eccentric shaft. The idea is quite a simple one and costs very little to produce.

Cone Clutches for Feed Starting Devices

The writer now wishes to elaborate somewhat on the question of cone clutches, more particularly as applied to the feed starting devices for lathes and other tools. Mr. De Leeuw shows a typical example of such a clutch. As regards the arrangement of the clutch surfaces to give equality of wear and continued success of operation, it is absolutely essential that the theories propounded by Mr. De Leeuw should be observed. If there is any overlap on either of the two friction surfaces of a cone clutch, sooner or later a shoulder will develop, which, though possibly quite minute in size and almost imperceptible, will seriously interfere with the correct operation.

At one time, it was the regular practice for a spanner to be used for engaging the friction feed of a lathe, and under these conditions it mattered little how great the pressure between the frictions was required to be—there was always plenty of force in reserve when a spanner was used. Later on, when hand-operated frictions were introduced, it became necessary, if successful operation were to be assured, that the clutch should be carefully designed so that by hand the requisite pressure could actually be applied.

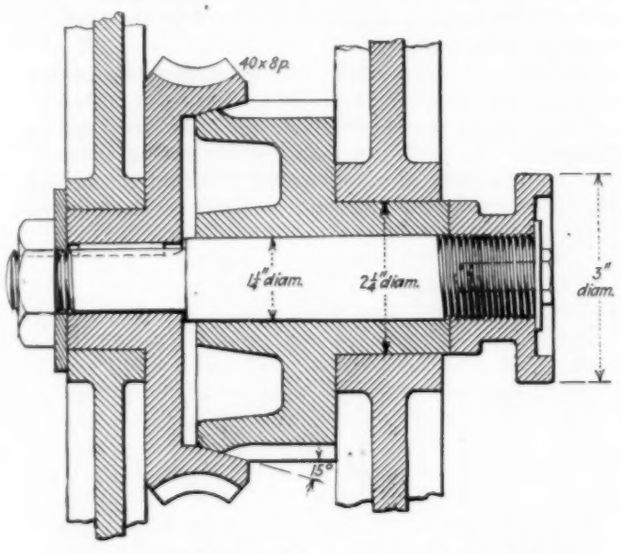


FIG. 4—A TYPICAL FEED FRICTION CLUTCH

Now it is perfectly true and probably within the experience of most readers that many of the so-called hand

frictions are not hand frictions at all. Through faulty design, it is almost impossible in many cases to engage the clutch with sufficient pressure to transmit the required load. The writer has often seen pieces of lead, spanners, and all kinds of weapons used to tighten the hand friction knobs. In some cases, it is a fairly easy matter to do the tightening, but if the cut has been

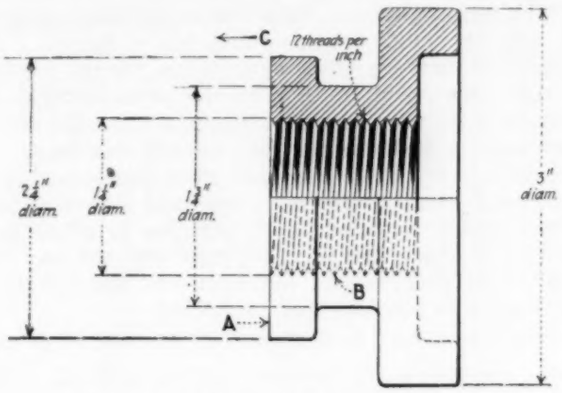


FIG. 5—ENLARGED VIEW OF HAND KNOB

moderately heavy, it is practically impossible to unclamp by the use of the hands alone. In other cases, the tightening is difficult because there is a tendency for the knob to slacken off under the cut.

The writer many years ago came up against these difficulties and got out a design of clutch which is claimed to be one of the most powerful on the market. But before describing the type of clutch evolved, it might be profitable to consider some of the forces with which the hand-operated knob has to contend—we shall then more clearly see the necessity for the principles adopted.

Forces on the Hand Knob

A typical feed friction clutch is shown in Fig. 4. The 40 x 8 pitch, cast-iron gear is required to be coupled at will to the worm gear by means of the 3-in. diameter hand knob. Now a cast-iron gear of the dimensions given will safely stand a tooth load of about 250 lb. As the mean diameter of the friction clutch is roughly equal to the pitch diameter of the gear, the circumferential pull of the clutch will also be 250 lb. If a 0.1 coefficient of friction is assumed, and P is the axial pressure on the clutch, with the angle of the cone 15 deg., then the actual axial pressure required to give a mean pressure between the friction surfaces of 250 $\div$ 0.1 will be $P = 250 \div 0.1 \times (\sin 15 \text{ deg.} + 0.1 \times \cos 15 \text{ deg.}) = 900$ lb. approximately. Now this means that the hand-operated knob must be able to develop an axial thrust of 900 lb. Let us endeavor to find the pull required at the knob's periphery.

There are really three loads on the knob: (1) That due to the development of the required pressure C, without considering friction; (2) that due to the friction at A in Fig. 5, between the face of the knob and the boss of the gear; (3) that at B, due to the friction of the thread.

The total effort required at the periphery of the knob will be the sum of the efforts necessary to overcome the three resistances mentioned. With the dimensions given and with the same friction coefficient of 0.1, the various resistances will be as follows: Pull on the knob to produce end pressure $= 900 \div (3 \times \pi \times 12) =$ 8 lb. Pull on knob to overcome friction of thrust faces $= 0.87 \times 900 \times 0.1 \div 1.5 = 52$ lb. Pull on knob to overcome friction of thread $= 0.62 \times 900 \times 0.1 \div 1.5 = 37$ lb. The latter ought really to be increased by between 10 and 20 per cent to allow for the increased pressure due to the angularity of the thread. This pressure has been ignored, however, as it does not very seriously affect the problem.

We find then that the three loads are equal to an effort on the knob of $8 + 52 + 37 = 97$ lb., of which 8 only is actually doing useful work, the remainder being swallowed up by friction. The writer by experiment, has satisfied himself that it is not practicable to exert more than 20 lb. turning effort *by hand* on a hand-operated knob. If more is required, it means considerable effort on the operator's part, and usually a two-handed effort, to clamp the knob, and this effort, will sooner or later be assisted by some outside instrument to secure easier engagement and disengagement. Obviously then, if 20 lb. is a reasonable figure, the 97 lb. given by our example will be very much wide of the mark. Yet it will be generally recognized that the arrangement is quite a usual one in every way, with nothing abnormal about its design. How is it possible to bring it within the realm of practical and successful mechanics?

It is quite obvious that the frictional loss is abnormal and that any economy of effort must necessarily be largely made from the saving in friction. If the whole of the useful-work load were cut out, there would only be a saving of 8 lb., that is, of course if the friction remained the same. In the first place then we will

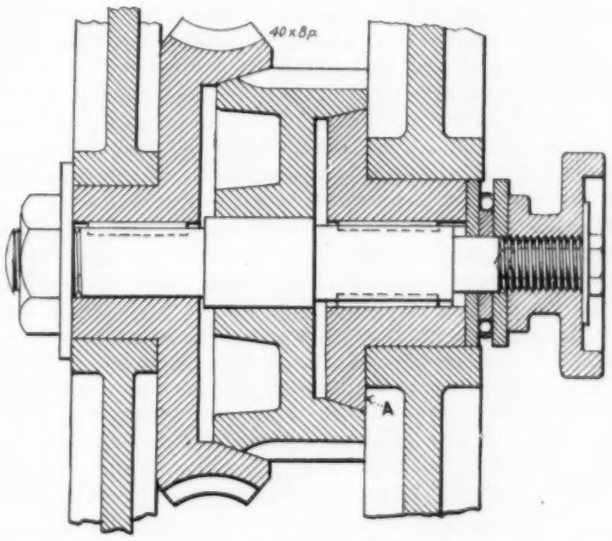


FIG. 6—IMPROVED DESIGN OF DOUBLE CLUTCH WITH BALL THRUST

eliminate the thrust friction at A in Fig. 5 by interposing a ball thrust bearing between the knob and the boss of the gear. While there would be some friction even under these conditions, it would be so slight with a ball thrust that, for all practical purposes, it can be said to have been eliminated altogether. This elimination will cut out the biggest of the three loads on the knob, reducing the required effort on the periphery from 97 to 45 lb., which, though quite a substantial reduction, does not bring us within our prescribed limit.

We could in the first instance have increased the diameter of the knob to a considerable extent. The ob-

jection to this course is that any increase would materially affect the operation of the machine, since it would be necessary to make the knob large enough for operation by two hands. In some examples, the size of knob has not been carefully proportioned, it being too large to operate comfortably with one hand and too small to accommodate both hands. Of course, if the knob were made large enough, it might be possible to secure the requisite pressure by only one hand, but in most cases the knob would then cease to be a knob at all—it would attain to the dignity of a hand wheel, and as such, would be rather clumsy in appearance on the carriage of a lathe. Our efforts are directed towards securing an arrangement which will be neat in appearance and, above all, which can be operated *comfortably by one hand*.

An Effective Design for a Clutch

The diameter of the thread on which the knob screws seems to be much greater than is necessary. It should be borne in mind that the knob is *hand* operated, and consequently, the screw can never be very heavily loaded. It should therefore be quite reasonable to reduce the thread diameter to ¾ in. so that, with the same pitch of thread, the load on the knob will now be 8 lb., as before, for the actual pressure, and $0.37 \times 900 \times 0.1 \div 1.5 = 22$ lb. for the thread friction, or a total of 30 lb. altogether. We are evidently getting nearer to the mark, but not yet quite near enough. If 20 lb. is the *comfortable* figure, then 50 per cent more will be tending very largely towards discomfort and non-success.

The design shown in Fig. 6 is the writer's solution of the problem, and he has used this design on all sizes of lathes up to 32-in. swing with never a single complaint respecting this particular portion. The worm gear is keyed to a shaft on which is also slidably keyed a male friction *A*. Between the worm gear and the sliding friction *A* is the 40 x 80 feed gear having a male friction at one side to engage the worm gear and a female one at the other side to engage the sliding friction. The whole of the three parts are clamped together in the ordinary way by a hand-actuated knob, of the dimensions given above, and fitted with a ball thrust.

With this arrangement, since there are two sets of friction surfaces almost equal in size, the axial pressure must be little more than half that of a single clutch of the ordinary type. Since there is a slight difference we will put the axial pressure at 60 per cent of the previous amount. This means that the pull on the knob will be now only $30 \times 0.6 = 18$ lb., or 2 lb. within our predetermined standard, and obviously, a great improvement on the 97 lb. of our original calculation.

It should also be noted with reference to the design shown in Fig. 6, that there is no tendency for the knob to either tighten or slacken under the influence of the cut. With the arrangement shown in Fig. 4, if there is any slip between the friction surfaces, the knob will tend to tighten itself when running in one direction and slacken when running in the opposite direction. The latter is not a very desirable condition as it might prevent the quick operation of the knob.

In conclusion, it is not suggested that Mr. De Leeuw's design will not "stay put"—there will be no tendency for the knob to either tighten or slacken—but the writer's design is offered as a much more satisfactory and more powerful arrangement.

Obstacle Charts

By L. J. Voorhees

The essence of a job is its Obstacles,
They're troubles that are hard to be found.
But success is attained by their solving,
So, let's each be an "Obstacle Hound."

THE purpose of the charts illustrated herewith is to help the busy executive find his obstacles. The solution of them we will leave with him for the present.

It is not enough to remove the obstacles that we stumble over, even if we do it promptly. We should hunt out the obstacles that are usually overlooked. It is better to find them and have them overcome before someone higher up discovers them and asks why they have not been attended to. It puts one in a bad light to have to make excuses. Perhaps you will say this is all good general talk, but what are some of these obstacles, and how can they be found?

An obstacle may be a change in the rate of production, a change in the price of a commodity, a change in the rate of movement of a commodity, a change in the quality of a commodity or product, or, a calamity. If there were no changes or calamities there would be little need for most of our executives. If a manager could telephone from his summer home to the workmen in his bossless factory and tell them to repeat last week's production, and then run down the last of the week and find it done, manufacturing conditions would be about ideal. But, unfortunately, due to changes or obstacles that arise in nearly everything that enters into or affects a product, a number of highly experienced men are required to overcome them.

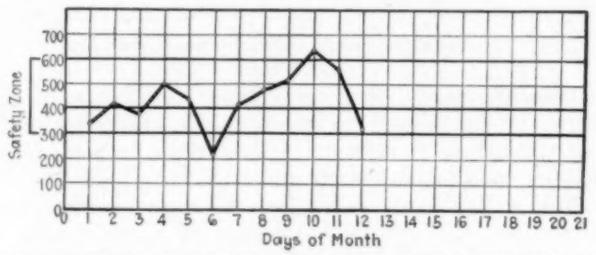


FIG. 1—OBSTACLE CHART FOR DAILY PRODUCTION OF 400 PIECES

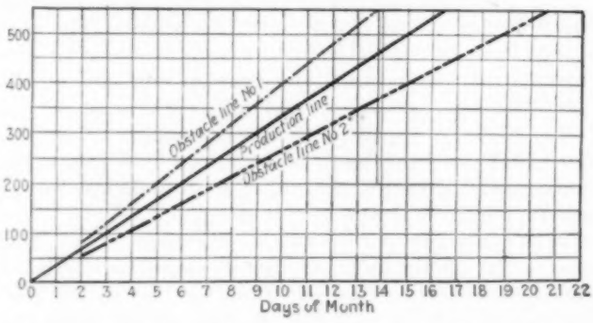


FIG. 2—A CUMULATIVE CHART WITH OBSTACLE LINES

In order to anticipate, find, or follow these fluctuations or obstacles, many men collect great masses of figures and then to save the time required to go through them repeatedly, they transfer them to charts where they are more visible. Still, these charts must be followed carefully by a frequent scrutiny in order

to derive the desired benefit, and even this requires a lot of time. Nearly all of this time can be saved by the addition of a few lines to the charts, or by the use of obstacle charts.

An ordinary clock is useful when you look at it but it is no good to get you up in the morning. An alarm must be added for that purpose and then it is called an alarm clock. Likewise, an ordinary chart is useful when you look at it but with the addition of zone or

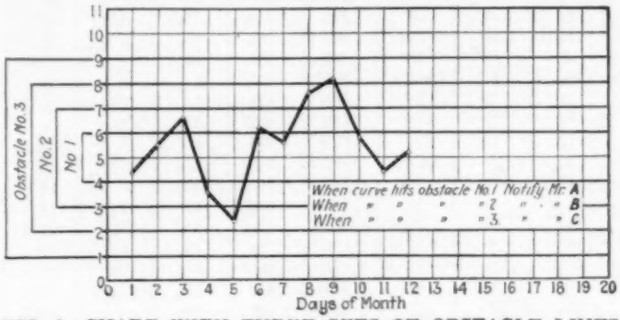


FIG. 3—CHART WITH THREE SETS OF OBSTACLE LINES

obstacle lines it gives a warning when an obstacle is encountered and therefore it is an obstacle chart.

Let's suppose, for instance, that your product is such that your machines run a number of weeks on an article, and it takes two weeks for that article to pass through its operations. When you start production you don't want to keep constantly running to each operation to see how it is going, and you can't afford to wait two weeks to see how the parts are coming through. So as you start each operation you prepare a chart to record its progress. Suppose you start the first operation at the rate of 400 parts a day and you record this on a chart something like the one shown in Fig. 1. Now in order to meet the demand this production rate

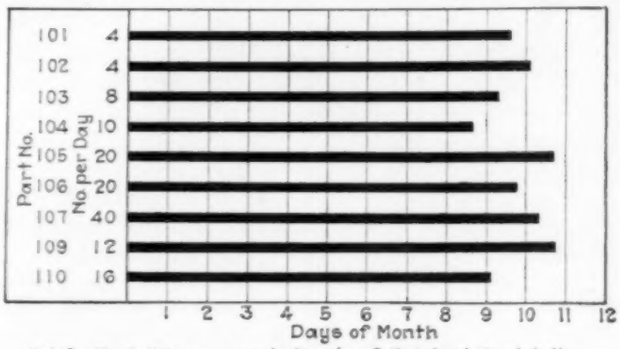


FIG. 4—CHART SHOWING PRODUCTION OF COMPONENT PARTS

should not drop below 300 a day and if it reaches 600 a day it is so exceptionally good that you want to know about it. Instead of continually looking at this chart or inquiring about it you place two obstacle lines on it, one at 300 and one at 600. Then you give instructions to the person who posts the chart to let you know when the production curve crosses either obstacle line. Now, unless the chart is placed before you, you know that material is coming in and that this operation is running as you intended. Therefore, you can give your time to something else.

How obstacle lines can be applied to other types of charts is shown in Figs. 2, 3 and 4. The one shown in Fig. 2, is a cumulative or Z-chart with obstacle lines. The one shown in Fig. 3, has three sets of obstacle lines and is used to record things of unusual importance where more than one person is to be notified. For instance, the superintendent might be notified when the curve touches obstacle line No. 1, the factory manager when it touches, or crosses No. 2, and the general manager when it crosses No. 3. Of course, the arrangement and values must be changed to meet particular conditions. The chart shown in Fig. 4, is used to record the rate of production of the component parts of a machine to insure a constant supply of parts for the assemblers and to prevent their being held up for some part that has been overlooked and has gotten behind. Letting the daily spaces opposite each part number represent a number of units of finished machines, keeps the production lines nearer even. If the machine assembly rate is four a day, then any production line that is a day ahead indicates that enough parts are ahead for four machines. The four machines may take four of these parts or one hundred. The obstacle on this chart is to keep the production lines ahead of the date line. When one falls behind, the chart should be placed on your desk. Then you can give your attention to the one that is behind. That is where these charts effect the saving in your time. They do not require continued watching as each one has its own tickler.

One of the hardest tasks a factory executive has is to find the things that really need his attention. Usually most of the day is spent in fruitless search, with routine matters and with minor troubles, while the overcoming of the real obstacles is either put off or slighted. The use of charts with an alarm attachment—obstacle charts—will save time spent in searching; will automatically bring the real obstacle to your attention, and give you more time to remove the causes.

Trouble with Countershaft Clutches—Is It Common?

BY H. MAPLETHORPE
West Bromwich, England

The countershaft pulley clutch such as is supplied with many machine tools and lathes, and lathes in particular, has caused me much anxiety and annoyance during the last 20 years. During that time, I have never seen a really good clutch for the countershaft. I have tried every kind of an adjustment and have had the pulleys rebored and bushed. In some cases I had to have them removed and replaced by fast and loose pulleys, which appears to me to be the only satisfactory remedy.

If you tighten the clutch adjustment, so as to make it grip sufficiently to drive the lathe with a heavy cut, then the clutch will not release the pulley when you want to stop the machine. On the other hand if it is not fairly tight it will not drive with a heavy cut. Then too, when the pulley bore gets somewhat worn, the pulley rides the clutch and the lathe will not stop. I have seen this kind of annoyance upon every kind of make of clutch and often the operator can be seen to throw off the belt on the cone pulley, rather than bother with the clutch.

At the present time I have under my charge a horizontal boring machine that will not pull and it will not stand still. I have a lathe that will not stop, so we have taken one belt off. I have two other good new lathes with countershaft clutches that retard output. What is the remedy?

Standard Dimensions of Nut and Tapper Taps

The accompanying tables show the dimensions of nut taps and tapper taps which were recently adopted by a number of leading tap makers. They are in line with the Commercial Standards formerly adopted by the Tap and Die Institute, published on pages 883 to 890, Vol. 57, of the *American Machinist*.

TABLE 15

STANDARD DIMENSIONS OF TAPPER TAPS

Diam. of Tap Inches	No. of Threads Per Inch		Diameter of Shank Inches	Length of Thread Inches		Length Overall Inches
	U.S. Std.	S.A.E.Std.		U.S. Std.	S.A.E Std.	
¼	20	28	.185	1⅝	1¼	12 & 15
5/16	18	24	.240	1 11/16	1⅜	12 & 15
⅜	16	24	.294	2	1½	12 & 15
7/16	14	20	.345	2¼	1 11/16	12 & 15
½	13	20	.400	2¼	1 11/16	12 & 15
9/16	12	18	.450	2½	1⅝	12 & 15
⅝	11	18	.503	2½	1⅝	12 & 15
11/16	11	16	.565	2½	1⅝	12 & 15
¾	10	16	.616	2¾	2	12 & 15
13/16	10	...	.679	2¾	...	12 & 15
⅞	9	14, 18	.727	3	2	12 & 15
15/16	9	...	.789	3	...	12 & 15
1	8	14	.834	3½	2⅝	12 & 15
1⅛	7	12	.933	3½	2⅝	15
1¼	7	12	1.058	3½	2⅝	15
1⅜	6	12	1.153	4	3	15
1½	6	12	1.278	4	3	15
1⅝	5½	...	1.383	4	...	15
1¾	5	...	1.484	4½	...	15
1⅞	5	...	1.609	4½	...	15
2	4½	...	1.705	4½	...	15

TOLERANCES

Diam. of Shank ¼" to ½" incl. = Size to Size minus .005"
Diam. of Shank 9/16" to 1" incl. = Size of Size minus .006"
Diam. of Shank 1⅛" to 2" incl. = Size to Size minus .008"

FORMULAE

Sizes ¼" to ½" incl. Diam. of Shank = U.S.S. Basic Root Diam.
Sizes 9/16" to 1" incl. Diam. of Shank = U.S.S. Basic Root Diam. minus .004"
Sizes 1⅛" to 2" incl. Diam. of Shank = U.S.S. Basic Root Diam. minus .006"

TABLE 14

STANDARD DIMENSIONS OF NUT TAPS

Diam. of Tap Inches	No. of Threads Per Inch		Diam. of Shank Inches	Size of Square Inches	Length of Thread Inches		Length Overall Inches
	U.S. Std.	S.A.E. Std.			U.S. Std.	S.A.E. Std.	
5/16	24, 32	...	.133	.100	1⅜	*1	4½
¼	20	28	.185	.139	1⅜	1¼	5
5/16	18	24	.240	.180	1 11/16	1⅜	5½
⅜	16	24	.294	.220	2	1½	6
7/16	14	20	.345	.259	2⅜	1¾	6½
½	13	20	.400	.300	2½	1⅞	7
9/16	12	18	.450	.337	2¾	2	7½
⅝	11	18	.503	.377	3	2¼	8
11/16	11	16	.565	.424	3	2¼	8½
¾	10	16	.616	.462	3¼	2½	9
13/16	10	...	.679	.509	3¼	...	9½
⅞	9	14, 18	.727	.545	3⅝	2¾	10
15/16	9	..	.789	.592	3⅝	...	10½
1	8	14	.834	.625	4	3	11
1⅛	7	12	.933	.700	4¼	3½	11½
1¼	7	12	1.058	.793	4¾	3½	12
1⅜	6	12	1.153	.865	5⅛	4	12½
1½	6	12	1.278	.958	5⅛	4	13
1⅝	5½	..	1.383	1.037	5½	...	13½
1¾	5	...	1.484	1.113	5½	...	14
1⅞	5	...	1.609	1.207	5½	...	14½
2	4½	...	1.705	1.279	6⅛	...	15
2⅛	4½	...	1.828	1.371	6⅛	...	15½
2¼	4½	...	1.953	1.465	6⅛	...	16
2⅜	4	...	2.042	1.531	6⅞	...	16½
2½	4	...	2.167	1.625	6⅞	...	17

*For 32 Threads per inch U. S. F.

TOLERANCES

Diam. of Tap Inches	Shank	Square
¼ - ½	Size to size minus .005"	Size to size minus .004"
9/16 - 1	Size to size minus .006"	Size to size minus .006"
1⅛ - 2	Size to size minus .008"	Size to size minus .008
2⅛ - 2½	Size to size minus .010"	Size to size minus .010"

FORMULAE

Diam. of Tap Inches	Diam. of Shank
¼ - ½	U. S. S. Basic Root Diam.
9/16 - 1	U. S. S. Basic Root Diam. minus .004"
1⅛ - 2	U. S. S. Basic Root Diam. minus .006"
2⅛ - 2½	U. S. S. Basic Root Diam. minus .008"

Size Square = Diam. of Shank × .75

Wrongly Used Statistics Encourage Depressions

BY C. T. BRAGG
Bragg Engineering Co., Detroit

The wrong use of business forecasts and the various statistical reports available to business men is responsible in some degree for the periodic upsets in business conditions. If you go to a fortune teller and he tells you that a dark man is about to enter your life, the chances are that you immediately think of a dark man to fit the description. You are likely to get yourself into a frame of mind that helps to bring on whatever the fortune teller foretold—particularly if it was something unpleasant.

It is pretty much the same way with business men who subscribe to statistical services. If the expert who writes the reports predicts a depression in any given month, most of his clients will stop buying until they can find out whether or not he is right. By so doing, they help materially towards bringing on the very thing of which they are afraid.

There can be no doubt as to the value of the work that is being done in analyzing business conditions and forecasting the trend of events in the commercial world. I have a great deal of respect for the very able men who are rendering this service. I do feel, however, that they could do more good by encouraging their clients to make a positive rather than a negative use of the facts thus brought to light. If the general situation of business points to a depression in any given month, the concerns that are advised of this condition in time can do a great deal to offset the danger by wisely distributed buying and by throwing the weight of their optimism and of their dollars into the balance at the right time, so as to cause a favorable reaction.

Almost every important business house in the country subscribes to one or more of the leading statistical services. The combined influence of these firms would be tremendous. If, therefore, instead of waving a red flag, the statistician would say, "Unless such and such steps are taken, there are indications of a coming depression," he would greatly increase his usefulness to industry as a whole. The action that should result from this service would serve to alleviate instead of aggravate the strain of the period.

Heat Treating Equipment in a Truck Plant

SPECIAL CORRESPONDENCE

The kinds of furnaces used, their arrangement and sizes —Pot for melting cyanide—Carbonizing and heat treatment for the different steels used in transmissions

THE NEW PLANT of the Moreland Motor Truck Co., at Burbank, Calif., has a very complete heat treating equipment, even though the plant is not a large one. This plant makes its own transmissions, and the heat treating equipment shown is largely used for that purpose.

The two large annealing furnaces shown in Fig. 1 are 8x6x3 ft. inside measurements, the latter dimension being the height above the table of the truck which handles the material in and out of the furnace. This truck, it will be noticed, has a floor built up of fire brick and has a channel *A*, around the outer edge. The side channels go around the projecting T-bars shown at *B* and *C*, while the edge *D*, on the door, lowers into the channel on the front. This arrangement seals the heat in the annealing chamber and prevents it from being dissipated below the floor of the truck.

In Fig. 2 are shown the three carbonizing furnaces, each 7x3x2½ ft. and at the left two tempering furnaces, each 48x30x19 in. These are all inside measurements. At the left of the tempering furnaces is a pot for melting cyanide, and at the extreme right, a small furnace for tools and similar work. The large quenching tank is shown in the foreground.

A direct supply line of natural gas makes this the natural fuel to use and the price is very reasonable.

The steels used are almost entirely S.A.E. No. 3120 or 3140, these grades being selected for the transmission gears and the shaft. All gears are drop forged and are annealed in the furnaces shown in Fig. 1, before being machined in any way. The annealing treatment consists of heating the gears up to 1,600 deg. F. and letting them cool gradually in the furnace.

Carbonizing is done in the usual way, using pots or boxes for holding both the work and the carbonizing material. The materials used are those prepared by E. F. Houghton & Co. The boxes are heated in the carbonizing furnaces to 1,650 deg. F. and held at this

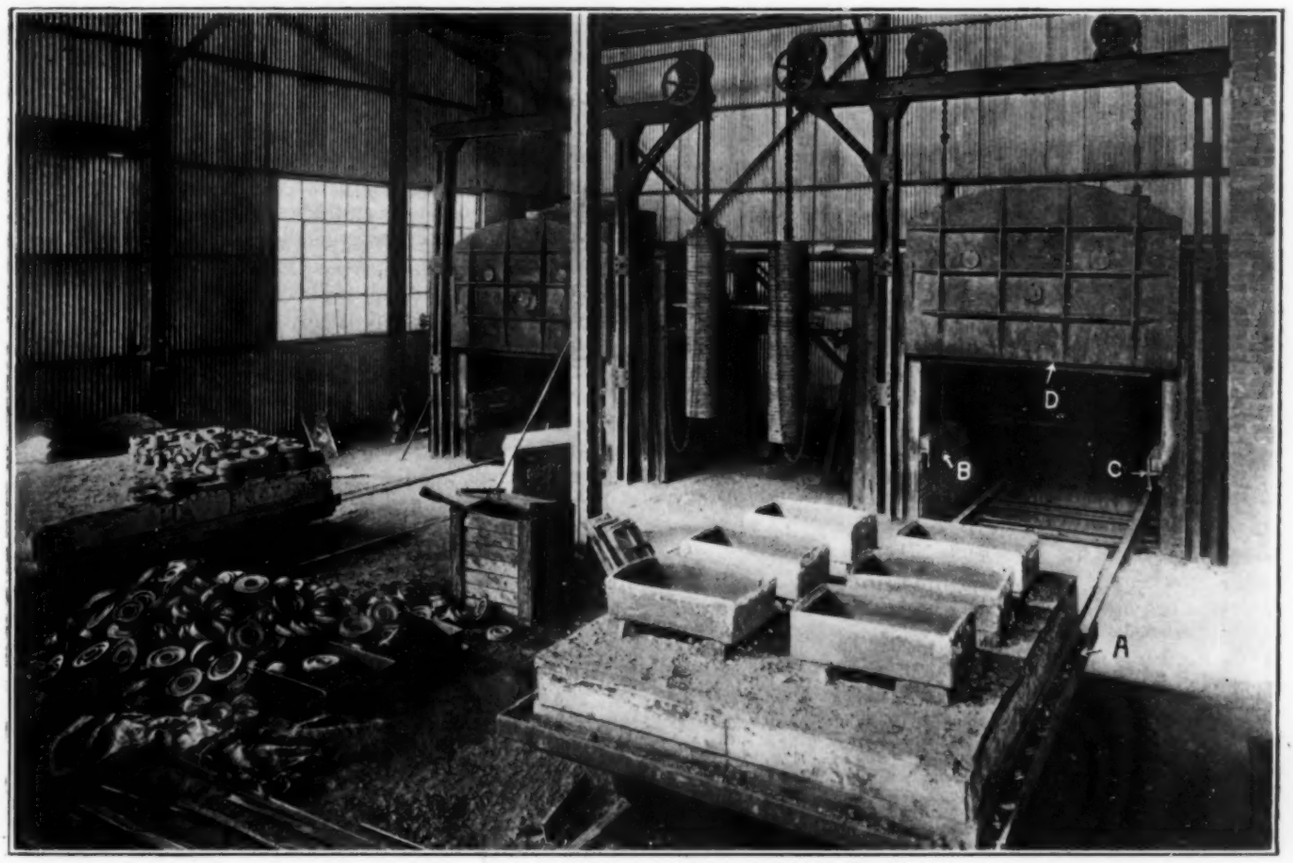


FIG. 1—ANNEALING FURNACES AND CARS

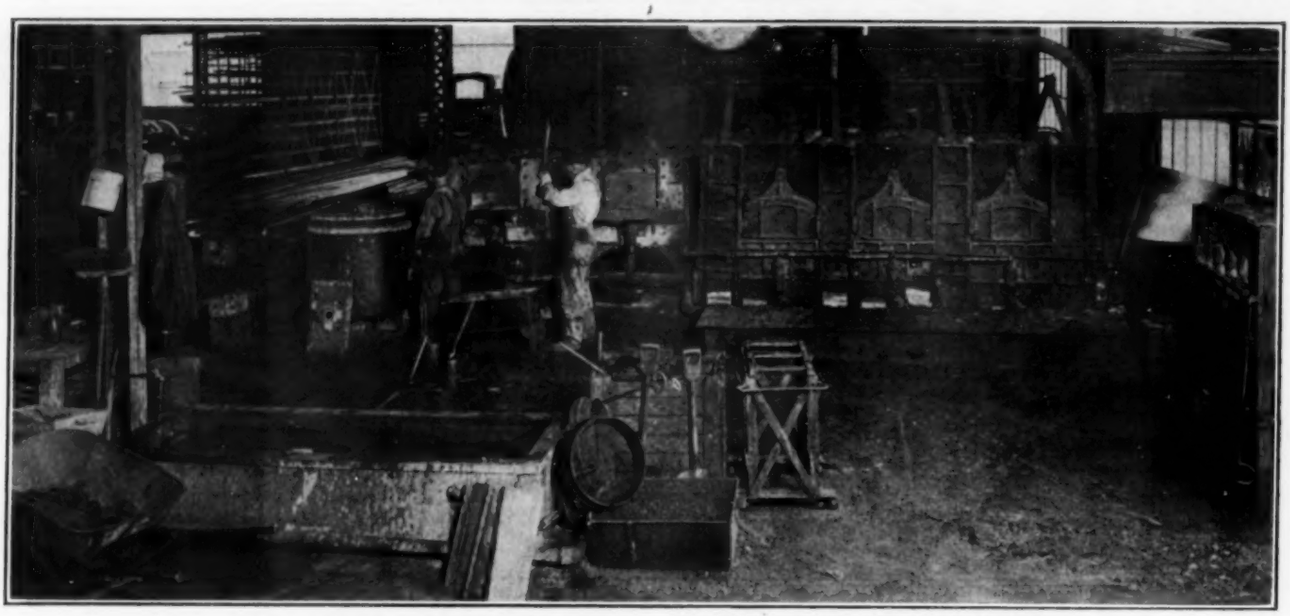


FIG. 2—CARBONIZING AND TEMPERING FURNACES AND QUENCHING TANK

heat for approximately six hours. The heat is then turned off and the work allowed to cool down with the furnace during the night, all carbonizing being done during the daytime.

After the carbonizing, the treatment is as follows: Gears are reheated to 1,650 deg. F. and quenched in oil. A second heating to 1,400 deg. F. and another quenching in oil follows. After this second quenching the gears are drawn at a temperature of 450 deg. Farenheit.

The heat treatment for shafts varies slightly from that for gears. The first two heatings and quenchings are the same, but instead of being drawn to 450 deg., the drawing heat is continued up to 800 deg. F., before the final quenching.

Both gears and shafts are tested for hardness by the Brinell method. Gears are kept between 425 and 450 and the shafts between 20 and 275, Brinell hardness. The equipment shown secures the desired uniformity.

An Old Time Shop in Old England

By J. T. Towlson
London, England

As I look back nearly fifty years to the time when as a boy, I served my apprenticeship in a little old-fashioned machine shop located in a prosperous Eastern city of England and compare the crude and limited equipment of that period with the strong, sturdy and powerful machinery of the modern shop; when I recall the makeshifts and improvisations to which we were obliged to resort to get out work that in size, weight and complexity was far beyond the recognized capacity of such tools as we possessed and weigh them in my mind against the methods of the present day in which every possible contingency is anticipated and splendid tools for every conceivable purpose provided; I am no longer surprised at the passing of the old time "all-round" machinist. He was a product of the conditions no less surely than was he who made axes of stones and tipped his spears with flint.

The machine shop lad of the present day has all his problems worked out for him in advance. When a piece of machinery is to be built it is known beforehand just how every job is to be done; how every part is to be machined. He has but to follow a "cut and dried" routine, with charts and diagrams to guide his every step. Under such circumstances it is small wonder that he should not develop the initiative and resourcefulness of the boys of an earlier day.

In the old days; there was the job—do it as best we could. Before a move could be made upon any but the most ordinary job, ways must be devised and means recruited from the meager resources at hand. It was, therefore, but natural that resourcefulness should be developed, that ingenuity and skill should go hand in hand, and that the youth whose wits were matched against such conditions and who was in constantly daily association with men who had gone through the same experiences before him should grow into a man capable of grappling confidently with any problem in iron and steel that might present itself.

In the shop where I learned my trade we had neither planer, slotter nor milling machine except such as were improvised for the occasion. Twist drills had barely made their appearance in the market and I do not remember ever seeing one in our shop. One piece of equipment that we *did* possess, however, and one that was not at all common in shops of that size, was a set of planed floor plates that together covered a space 26 by 36 ft. in size and that had planed T-slots in both directions at intervals of 12 in. These plates were located in front of a ten-ton pit lathe with 12-ft. face-plate, capable of swinging 20 ft. in diameter.

One of the jobs turned out in our shop, remarkable because of its size and weight when compared with our facilities for doing it, was three large cross-compound condensing horizontal engines that are today driving the Norwich mills of the well-known J. & J. Colman's Carrow works. Though these engines were built about 1877 they were contracted for under the exaction that they should develop one horsepower-hour for each two pounds of coal burned.

To handle this job we were obliged to resort to many

expedients; not the least of them being the building of the milling head shown in Fig. 1. This home-made device proved to be indispensable; for, in conjunction with the floor plates it became in turn a milling machine, a slotter, and at times a planer. It carried a four armed cutter head, or spider into which the cutting tools were fixed at a radial distance from center of 12 in. The drive was through a worm and worm wheel from a 20-in. pulley on the worm shaft and during the day its power was delivered to it through a belt

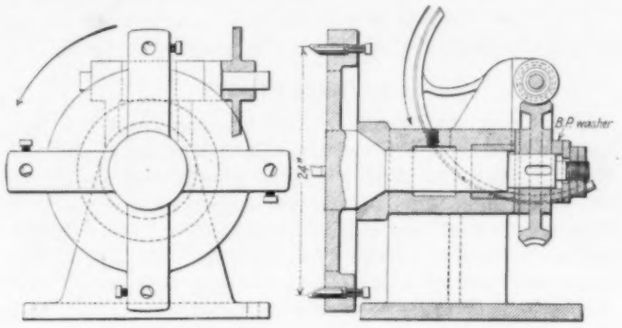
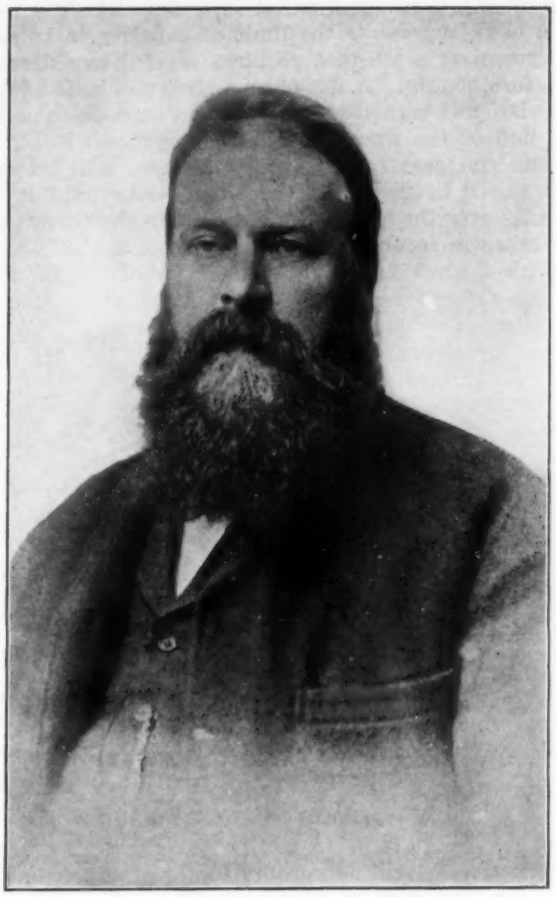


FIG. 1—A SHOP MADE MILLING HEAD

that was made to lead from the main shop line. At night (on overtime work), when the shop engine was not running, it was driven by a small rotary steam engine; also a product of the shop and later to be described.

Perhaps the most difficult and interesting of the many jobs performed with our equipment was the building of the flywheels for the above-mentioned engine. These were built-up wheels, each weighing 16 tons complete, 20 ft. in diameter, and were composed of a cast-iron hub, six rim segments and a corresponding number of cast-iron arms.

To finish the ends of the rim segments the milling



TED TOWLSON, AN OLD TIME ENGLISH **MASTER MECHANIC**

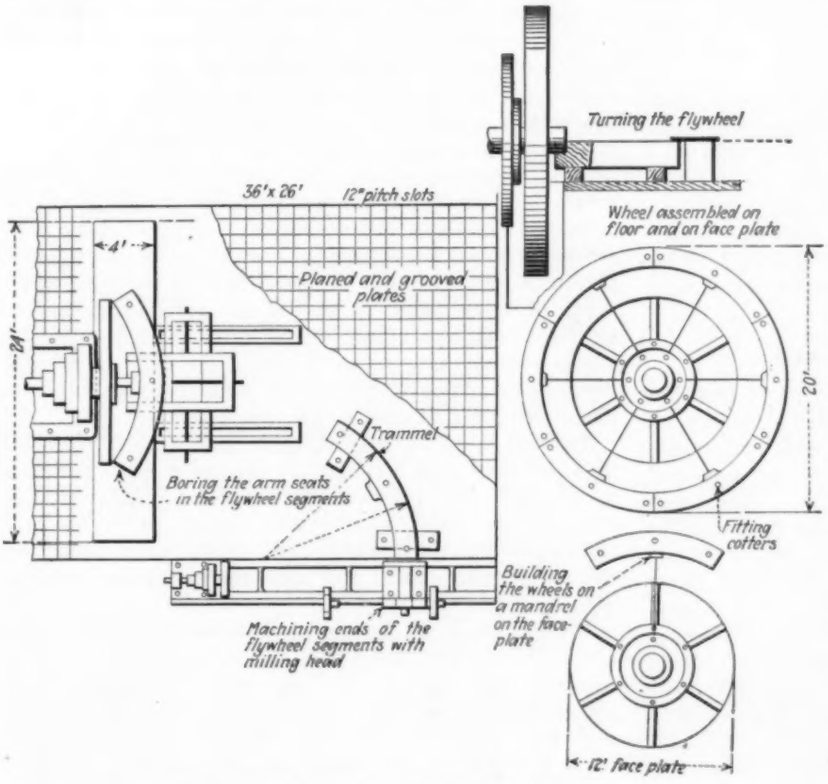


FIG. 2—MACHINING LARGE FLY WHEELS

head was attached to the saddle of an 18-in. x 25-ft. lathe that was placed along one side of the floor plates. The segments were blocked up on cast-iron stools, as shown in Fig. 2, to a height to correspond with that of the milling head and firmly secured to the floor plates. A temporary center was established on a pedestal and the segments located by means of a trammel and a straight-edge run out from the faceplate of the lathe. The lead screw of the 18-in. lathe supplied the feed movement.

The set-up for boring the boss in the middle of each rim-segment to take the arm is shown in the same sketch. The segment was mounted upon the heavy slide rest of the big lathe and located by squaring from the floor plate. It was centered with relation to the lathe spindle by gaging from the faceplate of the lathe, which made an excellent base line for this purpose. A short flanged arbor bolted to the faceplate carried an adjustable boring tool. Because of the rigidity of the set-up and the super-power of the big lathe, heavy cuts could be taken and the boring job was completed in excellent time.

Handling a 16-ton flywheel in a shop where a 5-ton rope block represents the limit of capacity in hoisting equipment is a job that requires careful consideration and forethought. A flanged mandrel was bolted to the faceplate and turned in position, and upon this mandrel the hub of the wheel was first assembled. Next, one of the rim segments to which an arm was cottered, was raised by means of the 5-ton blocks until it was directly over the hub in the lathe, when the corresponding arm was secured by cotters, or keys, to the hub.

With a plank brake under the edge of the faceplate

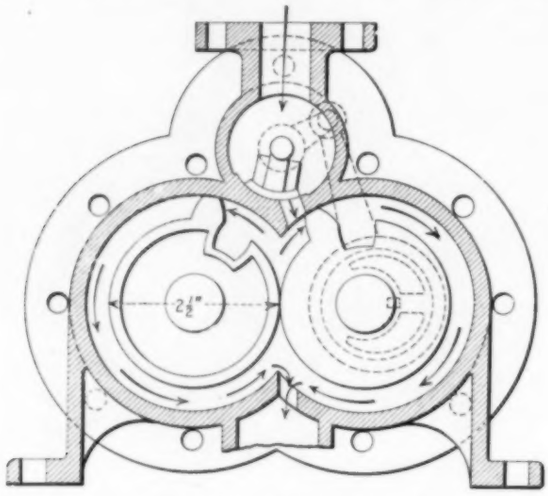


FIG. 3—SECTION OF ROTARY ENGINE

and the blocks still doing duty to forestall any unforeseen slip, the lathe was carefully rotated by pulling the belt until the segment was at the lowest point—down in the pit. A second segment was then placed opposite to the first and a condition of balance established. The remaining assembly was merely a repetition of the previous movements until all were in place, when all were securely bolted together and the wheel was ready for turning.

Because of the excessive overhanging weight upon the lathe spindle it was necessary to rig a temporary support under the outer end of the arbor, and this was done by placing a half box, fitted to the arbor, upon a pedestal that was secured to the floor plate. This remained in position while the wheel was being turned. When the turning was completed the wheel had to be dismantled and taken out of the lathe in the same way it was put in.

Utility of Cast Iron Floor Plates

The cast-iron floor plates of which frequent mention has been made were to us what a center line is to a draftsman—a point of departure from which all measurements were taken; and to which all set-ups and improvisations were made to conform. They cost several hundred pounds, but were worth, to that little shop as many thousands, for without them we could not have undertaken many of the jobs that with them seemed easy of accomplishment. So many and so varied were the uses to which they were put and so constantly were they employed as the basis of improvised rigging for doing unusual jobs that people who knew him were wont to say that what Ted Towlson (the writer's father, now long since dead) could not do with his floor plates and his brains, was impossible of accomplishment.

I have previously spoken of the little rotary steam engine used in the shop to furnish power at times when the shop engine was shut down, and in Fig. 3 I have endeavored to show a section through the cylinders that will enable the reader to grasp the details of its construction.

A duplex cylinder with intersecting bores having centers 2½ in. apart contained two revolving drums, each 3 in. long and each having a single tooth and space like a gear. These drums were geared together outside the case and one of the shafts carried an eccentric to operate the semi-balanced Corliss valve to admit and cut off the supply of steam at the proper moments.

The Drum Shafts

The drum shafts ran on ball bearings and had light leather glands to prevent the slight leakage that might occur around the stems. These glands and another at the valve stem were all the packing that was required. The drums ran very close to the heads of the cylinders but as there was no end thrust there would be no wear and consequently practically no steam leakage.

The engine ran at a speed of 1,600 r.p.m. on a gage pressure of 80 lb. of steam and furnished ample power to drive the milling head or lathe. It has often been used to drive large generators slowly for the purpose of truing up the commutators, and for turning wooden cogged mill wheels in place.

What Is a Screw Machine? —Discussion

By L. L. Thwing

I see from the article entitled "What Is a Screw Machine," appearing on page 177, Vol. 59, of the *American Machinist*, that Mr. Godfrey has been having another session with Johnson, who apparently is some relation to the late Mrs. Harris. I infer that Johnson is a modest man and not inclined to crowd his knowledge on us too fast. No doubt he knows what a screw machine is as well as any of us. He is probably old enough to remember that when he was learning his trade all screws, studs, etc., were turned on centers, which is a slow job and wastes stock.

Some time about the middle of the last century some Connecticut or Vermont Yankee conceived the idea of drilling a hole through the head spindle through which a bar of stock might be passed and gripped at the end by some sort of a chuck. This saved time because the pieces did not have to be centered nor the center holes turned off. Whoever made such a machine invented the basic principle of the screw machine.

Turrets were in use at that time and it probably did not take long to improve the original conception by the addition of a multiple toolpost. Whatever additions in the way of automatic chucks, wire feeds or cam activated movements have been added since are merely improvements and refinements of the original idea.

Today, when all lathes have hollow spindles, these cannot be used to distinguish screw machines. But we can say that any turret lathe that is equipped with automatic chucks, and bar or wire feed, is a screw machine. If it does not have these it is a turret lathe. If it is equipped for both bar and chucking work, it might be called a universal turret lathe.

Liability of a Collateral Contractor

BY LESLIE CHILDS

The right of the manufacturer to hold the collateral contractor liable for damages—A case of a contract providing for liquidated damages—Rules of the case

THE QUESTION of the right of a manufacturer, who contracts to complete a given contract upon a stipulated date or respond in liquidated damages for delay thereafter, to hold a collateral contractor, who contracts to furnish materials or supplies incident to the performance of the main contract, liable for such damages, where caused by the latter's default, is one of interest and importance to owners and executives of industrial plants in general. This point has been the subject of considerable litigation, and, while the holdings are not precisely in accord, it is believed the rule followed by the weight of authority may be fairly summarized as follows:

Where one enters into a collateral contract to supply materials or work, which are incident to the performance of another contract by his obligee, he may be held liable for all damages caused the latter by his breach of contract which were within the contemplation of the parties when the contract was entered into. If, then at this time, the collateral contractor has knowledge that his obligee may be compelled to respond in liquidated damages for delay in completing his contract, he (the collateral contractor) may be liable for such damages if caused by his default.

THE GENERAL rules for the ascertaining of damages in situations involving breach of contract by the collateral contractor are stated in part as follows:

"Those damages which are the natural and probable result of a breach of contract, those which the parties may reasonably anticipate as the effect of the breach under the particular circumstances of the case which are known to them when the contract is made, and those only, may be recovered in an action upon a contract.

"Proof of knowledge by the defaulting party at the time he makes the contract of special circumstances which make damages other than those implied by the contract, and naturally flowing from it, the natural and probable effect of its breach will warrant the recovery thereof."

The application of this rule of law is illustrated in a most striking and interesting manner in Northwestern Steam Boiler & Manufacturing Co., vs. Great Lakes Engineering Works, 181 Fed. 38. The facts and circumstances which culminated in the action were, in so far as material to this article, as follows:

The Great Lakes Engineering Works entered into a contract whereby it agreed to complete and deliver a steamship to the Cleveland Cliffs Iron Co. on July 20, 1905. The consideration for this undertaking was $380,000, and the contract provided that the engineering works should pay to the other $100 per day for the first ten days and $200 per day thereafter for any delay in completing the contract beyond the date specified above.

Thereafter, the engineering works entered into a contract with the Northwestern Steam Boiler & Manufacturing Co. whereby the latter agreed to construct and deliver two boilers for this steamship for a consideration of $12,450. This contract was entered into in January, 1905, and provided for the delivery of the boilers on June 1, of that year. The contract was not completed on time and the parties thereafter entered into another contract covering the boilers which provided for delivery on or before July 15, 1905.

At the time the first contract was entered into it appears that the engineering works informed the boiler company that the boilers were a necessary incident to the completion of the larger contract for the steamship; that it, the engineering works, was liable to the payment of $100 per day for the first ten days and for $200 per day thereafter for delay in completing the steamship; and that it, the engineering works, would hold the boiler company liable under this stipulation if completion of the steamship was delayed by a default in delivery of the boilers within the time specified.

The boiler company failed to make delivery according to the contract. The engineering works was unable, it appears, to complete the steamship within the time specified, and was compelled to pay the Cliffs Iron Co. $13,300. Six thousand dollars of this amount was claimed by the engineering works to have been caused by the delay of the boiler company in delivering the boilers. The instant action was thereupon brought against the boiler company in an effort to recover this amount.

The boiler company defended the action upon the grounds, among other things, that the $100 per day for the first ten days and the $200 per day for each day thereafter for delay, was so out of proportion to the profits it could have made on the boilers that these sums could not have been within the contemplation of the parties, as a possible liability of the boiler company when the contract was entered into. The contention being that the boiler company could not be held liable for these liquidated damages unless it agreed to be so

liable. The trial of the case resulted in a judgment in favor of the engineering works and the boiler company prosecuted an appeal to the higher court, assigning as error, among other things, the refusal of the trial court to instruct the jury that it, the boiler company, should not be liable for these liquidated damages for delay. The higher court, in stating the general rules for the ascertaining of damages in situations of this kind, in part, said.

GENERAL RULES STATED

"(1) Those damages which are the natural and probable result of a breach of a contract, those which the parties may resonably anticipate as the effect of the breach under the particular circumstances of the case which are known to them when the contract is made, and those only, may be recovered in an action upon a contract.

"(2) In the absence of proof *aliunde* of knowledge by the defaulting party at the time the contract is made of special circumstances which make other damages the natural and probable effect of a breach, such damages only as are implied by the contract itself, such as will naturally flow from its breach in the usual course of things, such as would reasonably be anticipated by the parties to such contracts in the great multitude of such cases, and such damages only, may be recovered.

"(3) Proof of knowledge by the defaulting party at the time he makes the contract of special circumstances which make damages other than those implied by the contract, and naturally flowing from it, the natural and probable effect of its breach, will warrant the recovery thereof."

Following the above statement of the general rules, governing the recovery of damages in situations of the kind involved in the instant action, the court directed its attention to the facts of the instant case to determine whether or not they brought it within the rules announced. In this connection it was, in part, said:

"There was evidence in the case at bar for the consideration of the jury to the effect that, before the contracts in suit were made, the boiler company was notified that the engineering works was liable for $100 per day for the first 10 days' delay in the completion of the steamship and for $200 per day for any delay thereafter, and that, if by its failure to complete and deliver the boilers at the time fixed by the latter contract it caused such a delay in the completion of the steamship, the engineering works would hold it liable for those damages.

"In the absence of evidence to the contrary, these damages appear to have been moderate and reasonable. They were stipulated to be the damages for the loss of the use of a steamship worth $380,000, and they do not appear to have any of the attributes of a penalty. The conclusion is that there was no error in the refusal of the court to instruct the jury that the boiler company was not liable for that portion of these damages which it caused the engineering works to suffer."

In conclusion, after considering other questions not material to this article, the higher court affirmed the judgment in favor of the engineering works rendered in the lower court. Holding, as outlined in the opinion, that in the light of all the facts, including knowledge on the part of the boiler company of the liability of the engineering works for these stipulated damages, it must be held liable for its proportionate share of such damages caused by its default.

The foregoing Federal case was well reasoned and its holding is without doubt in accord with the great weight of authority on the point decided. It illustrates in a most striking manner the great importance to the factory owner or executive of care in entering into contracts, which are from the standpoint of the obligee collateral to larger undertakings, which upon their breach may involve liability for liquidated damages based upon the cost involved in the larger contract. It is obvious that in such a situation the breach of such a collateral contract may entail a liability for damages far out of proportion to the sum of the contract price.

On the other hand, and looking at the case from the standpoint of the obligor in a large contract, who seeks to protect himself from liability caused by the default of one or more collateral contractors, who have agreed to furnish materials or supplies which are incident to the performance of the main contract, it is clear that it may be of the greatest importance for him to notify such collateral contractors of the probable liabilities entailed by a breach of the main contract. If this is done when the collateral contracts are entered into the obligee, as we have seen, may be in a position to protect himself from paying liquidated damages for delay upon his contract, at least to the extent such damages are caused by the default of the collateral contractors. Truly the case reviewed is one of force and value to every factory, manufacturing, or industrial executive, and its holding may with profit be kept in mind when contracts, similar to the one involved in the case reviewed, are being entered into.

Styles in Scratches—Discussion

BY HENRY K. SPENCER

There recently appeared on page 276, Vol. 59, of the *American Machinist*, an article under the title given above, by Frank C. Hudson, in which I was much interested. Mr. Hudson brings out the advances made in grinding very clearly.

I cannot, however, agree with one statement in the sixth paragraph which is, "and though the scratches show plainly, we now know that we cannot detect the depth with any measuring instrument." It is a rash statement in these days of optical methods of measurement to say a thing is so small it cannot be measured. However, in this case, it is probably not necessary to resort to optical methods. A micrometer carefully used will suffice to show the depth of the scratches on soft steel work, as ground on machines of the Blanchard type. This is done by grinding both sides of the piece, measuring it, then lapping both sides to just remove the scratches and measuring again. On cast iron, such as slide valves referred to in the article, the scratches would be more shallow and of course on hardened steel they would be very shallow, but no doubt their depth could be determined by measuring the thickness, lapping both surfaces, and measuring again, using a precision measuring machine instead of the micrometer.

It is, however, absolutely true that these scratches make no difference in the tightness of the joint formed by such ground surfaces.

In many quarters the prejudice against the curved scratches has entirely disappeared, and we find many people who look askance at any other kind of a finish because they suspect irregularities, rounded corners, etc., which cannot occur on the vertical-surface grinding machine product.

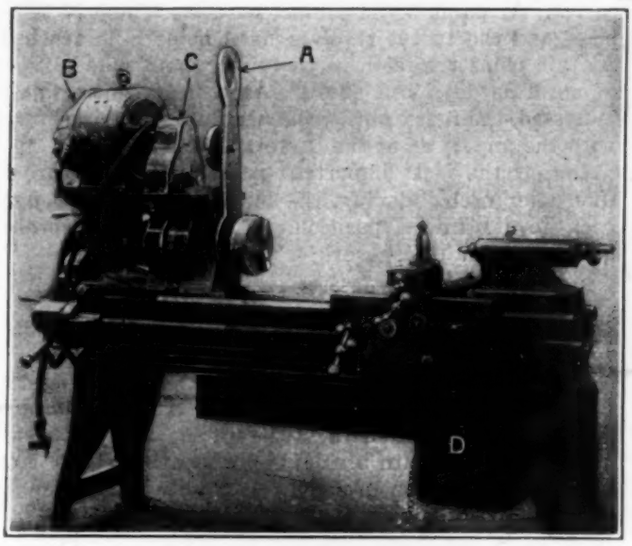
Ideas from Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for

A Portable Lathe

By Henry Barr

A short time ago, while in a railroad shop, I saw the portable lathe shown. They had taken a small size Lodge & Shipley lathe, bolted the eye *A*, to the headstock; mounted the motor *B*, on a bracket bolted to the top of the headstock bearings; connected the motor pinion to the large back gear by means of a gear train



A PORTABLE LATHE

under the guard *C;* and fastened a tool box under the bed at *D*. The whole outfit is carried from place to place by the crane, the hook being inserted in the eye *A*. An electric cable and plug connected to the motor make it easy to couple to the shop power-line almost anywhere. For many small lathe jobs this device beats sending the work to the machine shop.

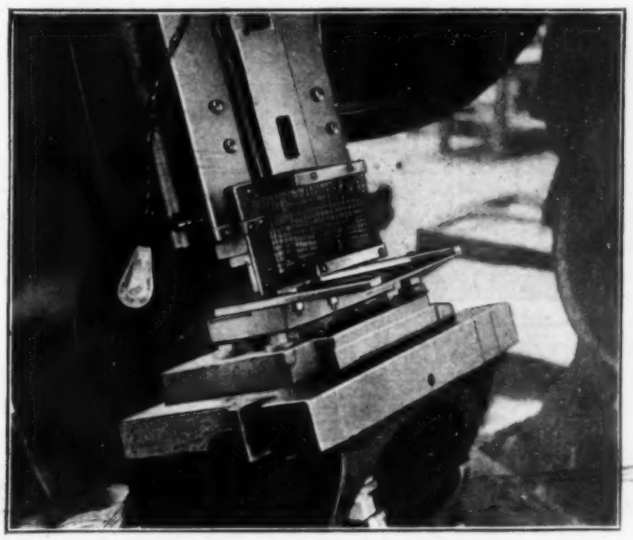
Stationary Guard for a Press

By William Denton

The press shown in the illustration is set up for a forming operation on sheet metal blanks. It is of the inclinable type and formerly stood in an upright position. It was not provided with a guard and the blanks were set in the tools by hand. The possibilities of accident were so great that the superintendent decided to guard the tools, and the means used to accomplish the result are here shown.

A sheet steel runway of suitable shape was made to attach to the top of the die and the press inclined so that when a blank is laid upon the projecting apron it will slide by gravity to its proper position in the die. The wire guard is attached to the gibs, and is stationary.

The operator places a blank on the apron and lets go, when the blank slides into place. The press is then tripped, the blank formed and, upon completion of the stroke, ejected from the back of the tools by a knockout.



A STATIONARY PRESS GUARD

The height of the guard above the apron is such that the operator cannot get his hand under it far enough to endanger his fingers, and if the press should be accidentally tripped while his fingers were under the guard, no harm would be done.

If a blank is displaced in the tools the operator is obliged to right it with a wire hook, or else get up from his position and go around to the back of the press, which he is not likely to do.

Turning Tapers on Old Lathes —Discussion

By J. T. Towlson
London, England

The setting over of the tailstock of a lathe for the purpose of turning tapers is an expedient of ever-present help in time of need, but of very doubtful value when accurate results are desired. Therefore the device described by Donald A. Hampson on page 809, Vol. 58, of the *American Machinist*, has its limitations.

When centers are thrown out of line by setting over the tailstock it may readily be seen that the conical surfaces of the center points no longer present a fair bearing to the work, but that such bearing as remains must necessarily be a line contact. Thus work turned on centers in this position generally requires excessive use of file and straight-edge.

A better way is to use ball-pointed centers and make hemispherical center holes in the work.

A Quick Acting Turret

By R. Delrue

The illustrations show a turret in which one turn of the binder handle to the left releases the stop and indexes the turret, while a fractional revolution of the handle to the right clamps the turret in working position.

The device as shown in Fig. 1, consists of a base *A* mounted on the lathe carriage by means of a dovetail slide on which the turret *B* revolves.

The operation is as follows: The binder handle is turned to the left and after making one fourth revolution, it comes in contact with the lower one of the nuts

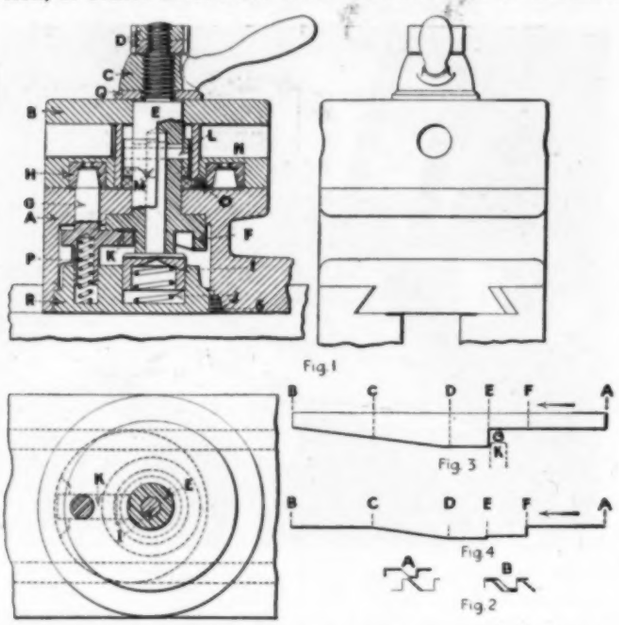


FIG. 1—QUICK ACTING TURRET. FIG. 2—TEETH IN ENGAGED AND DISENGAGED POSITIONS. FIG. 3—DEVELOPMENT OF THE CAM. FIG. 4—THE CAM PROFILE

D, bringing the stud *E* in rotation. Stud *E* has a cam-shaped flange *F* which acts on the index pin *G* and moves it gradually downward so that it is disengaged from the bushing *H*, leaving the turret free to revolve. To disengage *G*, one-half revolution is needed. The stud *E* is bored out to guide the coupling bar *I*, which is pressed upwards against *E* by means of the spring *J*. When the index pin *G* is brought down (through rotation of the cam *F*) its flange comes in contact with the coupling *I* and presses it down. By the downward motion of *I*, the pin *L* takes along with it the coupling sleeve *M*, in which four teeth are milled, meshing them with corresponding teeth in the bushing *N*. The engaged and disengaged positions of *M* and *N* are shown in Fig. 2 which also shows the form of the teeth and the clearance between them.

When *M* and *N* are in the position shown in Fig. 2, the turret is carried around, following the rotation of the binder handle after stud *E* has revolved 180 deg. When stud *E* has turned 45 deg. further, a sudden drop in the cam profile releases the index pin which is pressed upward by the spring *P*. This upward motion is very slight (about $\frac{1}{32}$ in.) and is not sufficient to disengage the coupling rings *M* and *N*. The pressure of the index pin against the under side of the turret acts as a brake, slowing its motion and assuring the engagement of the pin the moment one of the bushings comes in line with it. On entering the bushing, the index pin releases the coupling rings instantly. The next 45 deg. of revolution of the handle has no effect whatever on the mechanism, owing to the form of the cam *F*. When the stop-pin engages the bushing, the binder handle is turned to the right, clamping the turret firmly in position.

A development of the cam profile is shown in Fig 3. When the turret is in working position, the side *G* of the cam bears against the flange of the index pin as shown. When indexing the turret, the cam is moved in the direction of the arrow, and no action is imparted to the mechanism between points *E* and *A*. At point *B* the cam forces the index pin down and keeps it clear of the turret until point *G* releases it and allows it to press against the turret and act as brake. The index pin is engaged with one of the bushings at point *E*. The path of the cam is shown in Fig. 4. From point *E* to *A* and from point *B* to *C* no movement is imparted to the turret. At point *G* the contact between *M* and *N* takes place and the turret revolves until point *E* is reached. At this point the teeth of the rings come suddenly out of mesh as described above. As soon as this point *E* is passed, the index pin is released and comes in contact with the underside of the turret.

One of the most important points in this fixture is that after each indexing, the binder handle is brought back to its initial position, so that no interference between it and either work or the face is possible.

Turning Vitrified Abrasive Wheels

By William H. Cross

On page 952, Vol. 56, of the *American Machinist*, A. Lambercier of Geneva, Switzerland, tells of turning abrasive wheels with a steel tool. I have recently completed a similar job in much the same way and for the same reason; the bore of the wheels had to be enlarged in order to use them on a certain machine.

The wheels were 20 in. in diameter, 2½ in. face and 7 in. bore, the latter having to be enlarged to 8 in. They were of Norton alundum, grain 24, grade M. I held the wheels for boring in a Cushman 4-jawed chuck, using pieces of heavy cardboard under each jaw to avoid damage to the wheel.

As I could not easily make my lathe run slow enough to follow Mr. Lambercier's method of using a steel tool, I used a "Champion" emery wheel dresser, the handle of which I cut off and welded on again at a right angle to its former position so that I had something like a right-hand boring tool.

Running the lathe at 200 r.p.m. with a feed of $\frac{1}{64}$ in. per revolution of the lathe spindle and taking out $\frac{1}{16}$ in. at a cut, I soon had the hole bored from 7 in. to 8 in. in diameter. As the wheel was 2½ in. thick and my wheel spindle would open only to 2 in. between collars it was necessary to counterbore one side of each wheel to a depth of ½ in. and to a diameter of 11¼ in., for which purpose I used a straight dresser of the same kind as that used for the boring.

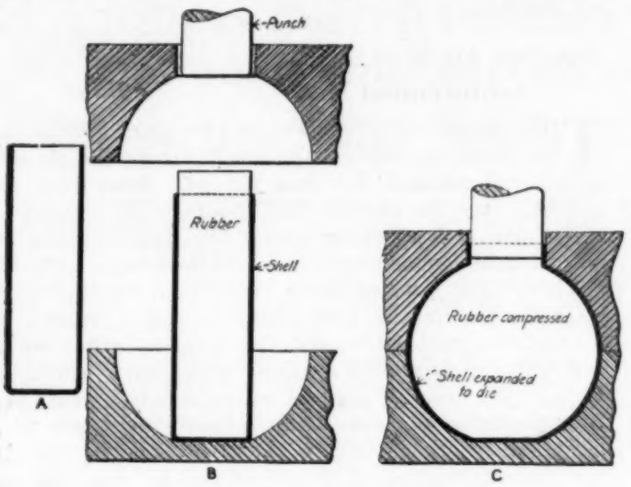
The time of boring and counterboring the wheels was approximately 1½ hr. each, floor to floor. As one set of cutters finished two wheels, I think it was an economical method. It was possible to take out as little material as $\frac{1}{64}$ in. on the finishing cut, and leave a clean, smooth and true hole.

Expanding Light Shells

By L. M. Francis

The making of small shells requiring to be expanded below the neck, sometimes offers difficulties.

I have seen rubber successfully used for the expanding process and have at present in mind the pro-



EXPANDING LIGHT SHELLS

duction of a shell, having the lower part expanded in the shape of a ball about 2½ in. in diameter. The illustrations show the method used.

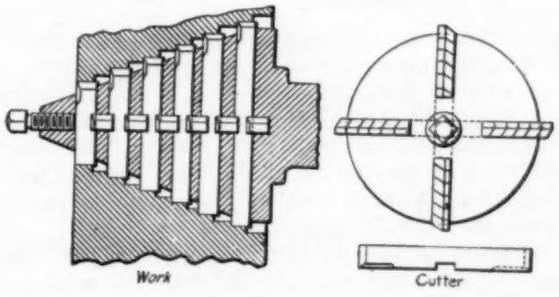
After the shell *A* has been drawn, a stick of live rubber is inserted and the whole placed in a die of the proper shape, as at *B*. In operating the press, the punch distorts the rubber so that it forces the shell to fill the die as shown at *C*. When the pressure is released, the rubber comes back to its original shape and can be withdrawn from the shell. Rubber of the right kind will stand long usage and can be used to expand several thousand shells of thin metal.

Rubber has been used in this way for expanding fairly large work and it would seem possible to employ the method described, to expand shells to irregular shapes and get very clear impressions.

A Taper Roughing Reamer

By Joe V. Romig

Roughing reamers used to break the scale and hog out the metal in cored holes are subject to rough usage and hard wear. On holes which are to be taper reamed,



A ROUGHING REAMER FOR TAPER HOLES

it is customary to first use a built up reamer of the interlocking-blade type for roughing. A head is turned up and slotted, as per sketch, and the cutters are inserted so that each successive cutter locks the one behind it, all being held by a set-screw tightened against the end cutter as shown.

When the cutters become dull, they can all be removed and sharpened. After the sharpening process has been repeated several times and the cutters are so small as to leave the bore with too much metal for the finishing reamer, they are taken out and a new cutter of the largest size is inserted in the proper slot, all the other cutters being advanced one slot toward the front and the smallest cutter discarded. In this manner the economy effected is very marked as most of the steel is actually used up. Because each cutter is rigidly held and well supported, tool breakage is held to a minimum.

Self hardening tool steel of rectangular shape is ideal for the cutters, and the notching in the center can be done with a rubber-bond grinding wheel. The heads are practically indestructable.

Improvising a Small Pulley

By Theo. Kruse

I recently had occasion to set up a slow-running machine that was to be driven directly from the line shaft, and required a pulley only 1 in. larger than the shaft, which was 1⅛ in., to give the desired speed. As it would be inconvenient to make a pulley with a bore so large in proportion to its outer diameter I adopted the expedient of wrapping gummed paper, of the kind used to seal cartons, around the shaft.

Having first scoured the shaft clean with abrasive cloth, I applied the paper by allowing it to run onto the shaft, unwinding from the roll and passing over a moistened sponge. When the desired diameter was reached I laid on a few turns of adhesive tape to secure the paper and to make a slight crown on the improvised "pulley."

The work required but a few moment's time, and the pulley is still running, with perfectly satisfactory results.

This scheme may be of help to others under like circumstances.

Making Piston Rings Round —Discussion

By E. V. Allen

I note on page 224, Vol. 59, of the *American Machinist*, a comment by Leonard A. Gary on my original article under the title given above. The method described by Mr. Gary will not make the rings round. It is common practice, I admit, but it isn't accurate.

If Mr. Gary doubts my statement regarding the roundness of rings produced by his method, let him carefully "Mike" one of his finish-ground rings over the split and then at a right angle to the split. He will find that the ends of the ring "stick up," and it is for this very reason that we bend the ends inward before grinding them, as I described. After bending we use practically the same method outlined by Mr. Gary. Owing to our method of bending, our rings are really round when finished.

American Machinist
Established 1877
KENNETH H. CONDIT AND FRED H. COLVIN
Editors

September 13, 1923

The Machine Tool Builder and the Procrastinating Purchaser

PROCRASTINATION is the thief of other things besides time when it leads an intending purchaser of a machine tool to postpone placing his order until tomorrow, or next month. The first loss, of course, is suffered by the customer himself who loses the profitable productive use of the tool during the time it takes him to bring himself to the point of placing the order.

The second loss is to the community as a whole. A potentially productive machine, idle from whatever cause, represents a certain amount of processed raw material and human intelligence, skill and effort withheld from useful work. While it awaits its opportunity for service, men somewhere are doing the work it was built to do, either laboriously by hand or with some less efficient machine. Dr. Steinmetz predicts that before many years have passed those who do the productive work in our mills and shops will be able to produce all that civilization needs by working four hours daily. He may be right, but that day will never dawn so long as productive machines stand idle in the builder's shop or on the dealer's floor.

But why should there be any finished machines in stock? Simply because it takes from three to four months to complete the average machine tool which, if compared to its best known product, the automobile, is in the Rolls-Royce rather than the Ford class. The builder, therefore, in order to take care of some of his rush order customers and also to keep his working force intact, must build a certain number of machines on speculation. The rush order is the bane of his existence. If it could be eliminated it would be possible for him to plan his production so that overtime would be done away with and the extreme peaks and valleys of the business curve flattened to a considerable extent.

As a matter of fact, the rush order for equipment is practically inexcusable in a modern business. With all the aids to business navigation that now exist ready to the hand of the commercial pilot, there is every reason to believe that a rush order indicates negligence or plain ignorance. It shows either that the purchaser knew he was going to need the machine and procrastinated about placing the order or else that he could not look far enough ahead to foresee the need in time to have it supplied in the regular way. The result of his lack of ability is that the machine tool builder's plans are upset by the last-minute order which he is anxious to fill if possible. There is a natural tendency to give such an order the preference over orders placed ahead without apparent need for hasty fulfillment and thus the interests of the really deserving purchasers suffer.

It takes considerable backbone to put such a purchaser in his place at the end of the order list, particularly if his organization is a large one. Yet it is the only safe thing to do as well as the just one, for the man who places his order early is the one likely to stay in the game longest and it is poor policy to run the risk of losing his business for the sake of pleasing the rush order procrastinator who thus proclaims his inefficiency.

Another Air Mail Achievement

THE introduction of beacons, or land lighthouses, has made possible continuous flying by the air mail pilots, and reduced the time for mail from four and one half days to twenty-eight hours. The service is, to be sure, still an experiment. But its possibility has been clearly demonstrated in a practical way.

There have been so many changes in transportation methods during the past thirty or forty years (the bicycle, the automobile and the airplane) that we do not fully appreciate the advances which have been made. It is hard to realize that, up to one hundred years ago, transportation remained at practically the same point as it had for thousands of years. The horse was still the fastest method of travel so far as mankind was concerned.

In this connection it is of interest to note that the first transcontinental mail service had two features in common with the latest development. The mail carried by the Pony Express was relayed in pouches from horse to horse and from rider to rider, just as the air mail was relayed from plane to plane and pilot to pilot. The striking difference is that the new method saves about twenty-three hours out of the day. In other words the airplane covers in an hour approximately as much distance as the Pony Express did in a day.

Night flying marks a new epoch in aviation. And the Post Office Department once more leads the world in the practical development of commercial flying. There are of course, likely to be occasional delays, as in any kind of transportation. But the mail service has proved that it is not only possible but practicable, and has added fresh laurels to its achievements in this line.

With well lighted air lanes and landing fields, commercial aviation should receive a new impetus. With the growth of aviation, as it is bound to grow, must come more and better airplanes, motors, instruments and other accessories. And all these add to the field for machinery of all kinds.

The Danger of Ultimatums

THERE is more lurking danger in an ultimatum than in anything we know of. It does not matter much whether it is the coal controversy or the Italian-Greek clash, the ultimatum stands in the way of a peaceful settlement. It was Austria's 24-hour ultimatum to Serbia which started the world war, and yet we seem not to have learned that an ultimatum is more dangerous that T.N.T. or poison gas.

Whoever issues an ultimatum gives notice that his case will not stand scrutiny by impartial eyes, so that it becomes almost an admission of unfairness. Abolishing ultimatums would be almost as much of an achievement as disarmament.

News Section

Railway General Foremen Hold Successful Convention

The seventeenth annual convention of the International Railway General Foremen's Association, held at the Hotel Sherman, Chicago, Sept. 4, 5, 6, and 7 was exceptionally well attended and successful from every standponit. The convention was called to order on Tuesday morning by J. B. Wright, the president, and invocation was asked by Rev. Robert O. Cooper of Chicago. President Wright delivered his annual address in which he reviewed the work of the association during the past twelve months and outlined the problems that were facing it during the next year.

On Wednesday, James C. Davis, director general of the railroads delivered an address that was especially interesting and thoroughly enjoyed by the members. Shop efficiency in the locomotive and car departments was the subject of a paper that was read by A. F. A'Hearn and Charles F. Baumann.

INTERESTING PAPERS

On Thursday papers were read by F. J. Spangenberger and W. S. Buntain. The former took as his subject the general repair methods and maintenance of valves, valve gears and power reverse gears and Mr. Buntain read a paper on the topic of general repair methods and maintenance of stokers, coal pushers and air fire doors. Discussions were also held on Thursday on various subjects. G. H. Logan conducted a discussion on shop kinks in the locomotive and car repair departments, while H. T. Cromwell was the chairman in a discussion on the welding of tires, flanges and other similar objects.

A motion picture showing the manufacture and uses of oxy-acetylene gas and equipment was shown on Friday and a talk on the subject was delivered by A. S. Kinsey, professor of shop practice at Stevens Institute of Technology.

The following officers were elected for the ensuing year: George H. Logan, of the Chicago and Northwestern R.R., president; H. E. Warner, of the New York Central R.R., first vice-president; Charles A. Barnes, Belt Railway, Chicago, second vice-president; B. L. Davies, Chesapeake and Ohio R.R., third vice-president; F. M. A'Hearn, Bessemer and Lake Erie R.R., fourth vice-president; William Hall, Chicago and Northwestern R.R., secretary and treasurer.

There were 71 exhibits and the registration showed an attendance of 102 foremen. There were excellent entertainments provided during the evenings and the entire convention was one of the most enjoyable and profitable ever held.

Southern Pacific's Expansion Plans

Improvements recently ordered by the Southern Pacific System will cost when completed $50,000,000, according to representatives of that system. This is in addition to the $40,000,000 that the railroad will spend this year in new equipment, including freight, passenger and refrigerator cars and additional locomotive power. The majority of the new improvements that have been ordered have for their purpose the improvement of the service of the railroad on the Pacific Coast.

Part of the $50,000,000 in new construction will include the building of new classifications and industrial yards, freight terminals, rock crushing plants, station buildings, additional shop equipment, replacement and strengthening of bridges, line changes to eliminate curves, new and heavier ballasting and heavier rails.

Canadian Companies Will Pool Patents

Following the example of a number of manufacturing companies in the United States, a group of electrical companies in Canada have agreed to pool their patents for the common good. Under the arrangement each of the companies agrees to license all the other companies within their natural field. The companies agreeing to the arrangement are the Canadian General Electric Co., the Marconi Wireless Co. of Canada, the Canadian Westinghouse Co., the Bell Telephone Co. of Canada, the Northern Electric Co., and the International Western Electric Co. Under the agreement the Marconi company will have access to all wireless patents, the Bell Telephone Company to all telephone patents, etc. The Canadian agreement is for the life of all existing patents and also covers future patents or application for patents.

Ford Report Shows Record Earnings

The Ford Motor Co. on June 30 last had a total cash balance of $210,293,922, assuming the good will item unchanged at $20,517,986, according to a compilation made public by Dow, Jones & Co. This is the largest sum ever publicly disclosed by the Detroit motor concern and is the largest cash holding ever reported by any industrial concern in the world.

The minimum profits indicated for the four months ended June 30 by a comparison of profit and loss surplus of the company's June 30 report and with a more detailed report filed in Massachusetts, were $54,351,560. Allowing for moderate depreciation, earnings on the Ford capitalization of 172,645 shares of stock are now placed in the "four-figure class." All these profits accrue to the Ford family, in which the entire ownership of the company is vested.

ENORMOUS CAPITAL

Total assets of the Ford company are $597,000,000, compared with less than $100,000 twenty years ago, when it was organized in the state of Michigan. At that time Henry Ford's total capital investment was only $28,000, some of which had been subscribed by friends of the present "giant of the motor industry."

The present surplus account of $414,129,158 compares with $359,777,598 reported on Feb. 28 last, $240,478,736 on the corresponding date of the preceding year, $182,877,696 on April 30, 1921, and $165,679,132 on June 30, 1920.

The Ford company at the present time is contemplating a program of expansion, it is understood, that will involve extensive purchasing of machine tools.

Gain in Machinery Export Total

Exports of metal-working machinery during July, 1923, with revised comparative figures for July, 1922, as compiled from the returns to the Department of Commerce were as follows:

	July	
	1922 *Value*	1923 *Value*
Lathes	61,443	96,780
Boring and drilling machines	28,059	67,505
Planers, shapers and slotters	33,881	32,538
Bending and power presses	7,351	19,030
Gear cutters	25,791	20,371
Milling machines	27,597	17,913
Thread cutting and screw machinery	16,756	27,913
Punching and shearing machines	9,223	16,666
Power hammers	8,973	20,005
Rolling machines	129,881	6,010
Sharpening and grinding machines	54,483	87,102
Chucks, centering, lathe, drill and other	17,519	36,504
Reamers, cutters, drills and other parts for machine tools	89,485	220,867
Pneumatic portable tools	41,980	54,946
Foundry and molding machinery	28,467	26,362
Other metal-working machinery and parts of	493,410	392,209
Total metal-working machinery	1,074,299	1,142,721
Automobiles and chassis (total)	5,165,643	9,405,885

Opportunity in Japan's Rebuilding Program

It is understood upon reliable authority that the Department of Commerce is making plans to care for the unusual situation in Japan caused by the recent earthquakes. Rebuilding will no doubt require many American machines and tools, and the representative, who it is expected will be appointed, will be on the ground to care for the interests of American manufacturers.

Railroads Buying in the New York Machine Tool Markets

After a week of extreme quietness, the majority of dealers in the New York district report improved business and a bright outlook. Railroads are the purchasers this week and reports come to the Metropolis that the Pennsylvania, New York Central and New York, New Haven & Hartford railroads are all purchasing rather heavily and that all of them also have important and formidable lists out.

Considerable buying and inquiring is reported from the American Locomotive Co. and from the General Electric Co. Several deals of considerable proportions were reported during the week with these two concerns and it is understood that further purchases will probably be consummated during the month.

Automobile manufacturers are inquiring persistently. One maker of a popular priced car made near New York has been to nearly all dealers in machine tools with a request for catalogs and price lists. Buying is expected within the next week from this source.

Expansion is more noticeable among the general industrials at this time than at any time before this year. One dealer reports that he has recently closed a contract amounting to more than $60,000 for new machine tools to be used by a manufacturer who has recently taken on more space.

The future for business during the Fall months and up to the first of the year is regarded as good with the word "steady" being used to either characterize the hopes or the anticipations of the dealers.

Dealers in used machinery report business as much better than during the months of June or July with industrials doing the buying. Difficulty has been expressed by dealers in these lines in obtaining just what they want in the way of machine tools, especially of the heavier types.

Pittsburgh Trade on Sound Basis

While the midsummer dullness hangs on to a certain extent, the machine tool and equipment market in western Pennsylvania encourages the trade by reason of its soundness, with conditions somewhat improved over that of a few weeks ago, and inquiries becoming more numerous week after week. This is taken to mean that as soon as specifications are approved there will be a lot of orders entered upon the books of the dealers in this district. The Pennsylvania R.R. has a large list of needs for its lines West, and it is expected that purchases will be made this month, as indeed some have already been made, after the necessary tabulation had been attended to at the Philadelphia offices.

As to buying, there is always something doing along this line, involving from two to four machines at a time, those particularly noticed in the past few days being two 28-in. shapers to a Western user; a 60-in. boring mill to a Pittsburgh manufacturer; one each motor-driven lathe and shaper to a coal company across the state border in West Virginia; and a number of small items of machine tool and equipment by the other dealers.

Business More Brisk

There has been a slight impetus given to the machine tool trade by the structural shop and plate working machinery movements, which have accelerated orders in small tools. A local company closed on approximately $40,000 worth last week, and is figuring on increasing this complement. It cannot be said that there are any large lists in new inquiries, yet a better rate of inquiry right now indicates good business for September and October.

There seems to be some shopping around by dealers in used machinery, especially in certain styles of machines that are scarce, one inquiry from the South covering ten small machines. Among the sales of such last week was a 30-in. planer and a vertical boring mill to two Pittsburgh users.

Among the inquiries sent out by the leading steel manufacturers were about fifty items, including cranes for the Carnegie Steel Co. and the Jones & Laughlin Steel Corp. It is believed that the first named concern will be in the market soon for locomotive cranes at its Mingo Junction and Edgar Thomson plants. Several traveling cranes were recently bought and installed by the Railway Steel Spring Co. at Latrobe, Pa., while the Cambria Steel Co. bought tables, shears, etc., from the Mesta Machine Co.

Canadian Trade Is Improving

Business conditions throughout Canada have shown no marked alteration during the last two or three weeks except that unusual midsummer dullness is drawing to a close. For the time being, attention is riveted on western Canada where the situation is better than it was a year ago, and considerably better than two years ago. Harvesting is sufficiently advanced to warrant a prediction with reasonable certainty as to the wheat production of 1923. As crop cutting nears completion and threshing operations advance, estimates as to quantity and quality are more liberal than those founded upon conditions existent three weeks ago.

In manufacturing, the output is being measured by ascertained demand in most lines both as to domestic and export requirements. Canadian automobile plants are reported to be operating at capacity and some manufacturers are expecting an increasing market. Sentiment in the metal market is decidedly hopeful as to the immediate future.

Future Looks Bright

In many instances it is said that the downward trend of prices has been checked at least for the time being. With the readjustment of labor troubles in Cape Breton, the production of iron and steel will be enhanced by the normal output of the British Empire Steel Corp. Improved buying of steel stocks, particularly machine tools is reported by Montreal and Toronto dealers.

The labor situation is now much more favorable and a further small increase in the volume of employment was reported by the Dominion Bureau of Statistics at the beginning of August. Employment in the manufacturing industries on the whole was less active than at the beginning of July.

The temporary outlook for a few months at least is good. Beyond that, uncertainties prevail. Building construction, large railway expenditures, and the spending of high wages throughout the industrial districts, have created an enormous volume of consumption. That this is still going on, the record of freight loadings bears evidence. These for the first seven months of this year were twenty per cent greater than the average for the same period in the preceding four years.

Milwaukee Reports Improvement

A survey of the foundry and machine shop situation in Milwaukee for the first ten days of September reveals evidence of a further improvement in the number and volume of orders being booked. At the same time sales of machine shop equipment of all descriptions have increased, even if in lesser proportion. Tool trade is not yet so active as might be desired, yet it is gratifying in the fact that steady betterment can be noticed. The steady nature of patronage of machine shops is accepted as a forerunner of heavier tool trade in due course.

Automobile shops continue to be the most active buyers of machinery as well as the heaviest buyers patronizing foundries and machine shops. It has been surprising that buying of units, parts and other materials, as well as accessories, should reach the proportions noted in July and August. Manufacturers as a rule have in past years slowed down orders as July 1 approached, and demand did not then again rise until the middle of August, after new production schedules had been outlined for the Fall and Winter season. This year there was hardly a break and local shops have had the benefit of a steady run of orders throughout the year, with every reasonable prospect that there will be no sharp peaks and valleys in the course of demand until at least Dec. 1.

The Railroad Trade

Local machine tool manufacturers have received some orders from railroads for shop equipment, but the principle business traceable to railroad sources has been with manufacturers of railroad supplies and materials. On the whole, the volume of this business has been below expectations, but the hope that it will reach expected proportions has not passed.

General industrial metalworking shops have continued their policy of buying only against bare necessities, and taking used tools as an economy when their condition will bear comparison with new tools. This character of buying prevents volume. It appears that for the present the majority of concerns are satisfied with existing capacity and probably will take no steps to provide further capacity until next

Spring to avoid high costs of buildings and equipment. Only a marked increase in new business, with features pointing to a sustained character of such patronage, can induce substantial enlargement of works during the coming four to six months in the opinion of authorities.

It is to be noted that while the organization of new concerns in the metal trades field is increasing, none of them has the appearance of the magnitude which will mean acquisition of round lots of equipment, or large volume orders for tool concerns. Nevertheless, these enterprises are helping dealers in used equipment to make prompt disposition of considerable numbers of items, which is keeping stocks from reaching an undue and uncomfortable size.

The labor situation has experienced a little relief with respect to ordinary, common workers, but skilled men are still exceedingly scarce. It is said, however, that the excessive turnover noted in the first half of the year and which showed a slight decrease in July, improved further in August.

St. Louis Hopeful of Improvement

A considerable degree of irregularity exists in the machine tool market in St. Louis. The hoped-for improvement has not arrived. There are some shops that are doing a good business, while others have cut the working hours of their forces or have made cuts in the number of men employed. But on every hand there is evidence and belief that business will be better. The railroads of the Southwest report car loadings that surpass all previous records, prospects for large crops are good and the automotive industry has shown no appreciable decline in production.

But when it comes down to buying machine tools it is or seems to be a different matter. The railroads after a little flurry of buying lapsed back into their Summer habit of purchasing practically nothing. The automotive plants are buying some boring tools at present and this seems to be the only line in which there is any active demand.

Money Is Slow

Collections are not what they should be, some firms reporting that they are having difficulty in keeping their collections up to date and only a few bills are being discounted. Even those firms which are in the habit of paying their bills promptly are slow in making remittances, it is stated.

The Federal Reserve Bank statement for the eighth district in regard to iron and steel products reports that, "Some improvement in new buying in this classification took place during late July and the first half of August was marked further betterment. Buyers generally seem more disposed to accept current prices and many heavy consumers who have deferred filling their wants in hopes of more favorable terms are now coming into the market. There was the usual seasonal slowing down in operations at mills, foundries and machine shops, but plans are being made to increase production with the return of cool weather."

Improved Conditions Reported from the Chicago Markets

There is some improvement in sales and inquiries in the Chicago district and dealers anticipate a better market during September. There appears to be a tendency on the part of several concerns whose inquiries have not been closed to make purchases now and dealers hope that the curve has turned upward. They do not, however, expect a rapid upward movement but rather a gradual increase in business until the end of the year. Consumers do not anticipate lower prices of machine tools and the establishment of the eight-hour day in the steel industry appears to have given some reason to believe that if there is any changes in prices it will be upward.

Punch presses seem to be the best sellers this week, but a few lathes have been sold. Railroad buying is quiet. The Pere Marquette Ry. is said to have purchased three 5-ft. radial drills, one rod borer, one 42-in. vertical milling machine, one 53-in. boring and turning mill, one 36-in. slab milling machine, one 44-in. boring and turning mill, one 36-in. planer, one 100-in. tire boring and turning mill, a locomotive axle journal turning lathe, one 1,500-lb. steam hammer, one 2500-lb. steam hammer, one 6,000-lb. steam hammer, three axle lathes, and one plate flanging clamp. The Central R.R. of N. J. is about to issue an inquiry for a number of machine tools. Dealers in second hand machine tools report a fair business with prospects for improvement in the Fall.

Railroad buying of iron and steel rails featured the iron and steel market during the week. Around 80,000 tons were placed by several important carriers and inquiries were in the market for additional tonnages. Production of steel continued to decline, although new orders registered a slight gain. Prices were being well maintained and less talk of advances was noted. Marked advances in old iron and steel were reported in the Chicago district, with dealers speculating freely.

Inquiries Increase in Buffalo

The most hopeful sign of recovery from the dullness that has been so obvious in the Buffalo machinery market since about the first of July, is the large number of inquiries that local distributors have been receiving during the past ten days. While there is a more active interest evident in many lines of manufacturing, few actual orders are being closed and so far as sales are concerned the market might still be said to be at a standstill.

One representative of a large distributing company, however, is quite optimistic. According to this office, if the company can close a fair share of the outstanding inquiries that have come in and on which the company has been working during the past five or six weeks, it will be assured of at least a normal September and October business and if anything beyond this developes these two months promise to be far over normal.

In general, machine shops are quiet, with a few scattering orders for single items, but no large lists out. The automotive field is only fairly active. The recent announcement by a radiator manufacturing concern in the western New York territory that it would immediately begin the erection of an addition to cost $500,000, including machinery, promises to liven things up a bit.

Large machinery sales are dull, one firm stating that an order for a boring mill placed the latter part of June is practically the only piece of heavy machinery they have sold this Summer.

The railroads are buying a little machinery, although mostly light tools.

The crane market would be better if manufacturers could fill their orders. Some firms, however, are now booking for 1924 delivery and local representatives report that it is difficult to close any orders five or six months ahead.

Firms which handle such things as safety valves, gages and other boiler trimmings for house radiation report a fairly steady demand with some very sizeable orders being placed.

Practically no orders are being placed in the Buffalo field by large central stations for motors, generators, transformers, switchboard sets and the like, but as many of these corporations are controlled by interest in New York and Philadelphia, this condition is probably not a true index to actual conditions.

Safety Council Will Meet in October

New York State, through the agency of the State Department of Labor, will play a prominent part in the twelfth annual congress of the National Safety Council, which meets in Buffalo during the first week in October.

Three thousand five hundred industrial safety experts from all parts of the United States, Canada and a number of European countries are expected to participate. The congress, which meets this year in conjunction with the annual safety conference of the New York State Department and the convention of the American Association of Industrial Physicians and Surgeons, will be the most important ever held in this country by agencies which are actively engaged in the effort to reduce the number of accidents and deaths in industry, the State Department of Labor announces.

More Modern Railroads for Japan

The speedy rebuilding of Japanese railroads and the replacement of equipment destroyed by the earthquake by the most modern types, is expected by railroad engineers and executives of locomotive companies in the United States. Among them the belief generally prevails that the credit of Japan is sufficiently sound to provide for the financing of such replacement.

Personals

C. B. WHEELER has been appointed general manager of the Cincinnati Screw Co., Loveland, Ohio, succeeding I. W. PETTINGILL, who has resigned.

H. R. GEIGER has been appointed the New York manager for the Standard Turbine Corp., Wellsville, N. Y. His office is located at 350 Madison Ave.

JOHN G. PANGBORN, F. E. WOLF and H. D. GATES will be in attendance at the booth of the Pangborn Corp., Hagerstown, Md., at the International Steel Exposition to be held in Pittsburgh, Oct. 8 to 12.

WILLIAM HALL, representing Spear & Jackson, Ltd., Sheffield, England, manufacturers of tool steel, hardware lines and tools, is visiting in Toronto. He is making a trip around the world on behalf of his firm, and while in Canada is visiting the customers and representatives.

E. D. SPICER, Wellsville, N. Y., has resigned his position as works manager of the Kerr Turbine Co. to become the general manager of the Standard Turbine Corp., Wellsville, N. Y.

GEORGE WHITE has been appointed superintendent of the Davis Boring Tool Co., St. Louis, Mo.

A. D. STEWART has been appointed branch manager of the Butte, Mont., office of the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., succeeding R. J. COBBAN, who has been transferred to the Seattle office where he will give special attention to mining problems.

N. B. NORRIS has been appointed manager of the New Orleans office of the Pawling & Harnischfeger Co., Milwaukee. His headquarters will be in the Whitney-Central Building.

C. M. DAVIS has been appointed manager of the reamer department of the Davis Boring Tool Co., St. Louis, Mo.

J. C. MCELROY, who has been the district manager of the Cleveland district for the Merchant & Evans Co., Philadelphia, has been transferred to the Detroit district as manager.

ROLLA WELLS, the receiver for the United Railways Co., St. Louis, Mo., has been authorized to spend $1,218,806 for equipment, repairs and improvements during the remainder of the year.

L. C. LAMONT has been appointed office manager of the Los Angeles office of the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., succeeding J. R. DEERING, who has resigned.

JAMES VAN BUSKIRK has been appointed manager of the Detroit office of the Pawling & Harnischfeger Co., Milwaukee. His office is located at 1124 Book Building.

S. J. CARROLL has been appointed manager of the Cleveland district for the Merchant & Evans Co., Philadelphia. His headquarters are at Champlain Ave. and West Third St.

RALPH H. ACKERMAN, who for nearly two years has been chief of the Latin-American division of the Bureau of Foreign and Domestic Commerce, has been appointed commercial attache at Santiago, Chili, and will leave for that post about Sept. 15.

A. G. CROCKER, formerly special power representative for the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., has been appointed manager of the industrial division of the Detroit office, succeeding E. A. WOOTEN, who has been assigned to other work.

N. S. BATES, for many years connected with the Pratt & Whitney Co. in the capacity of superintendent of equipment, has resigned and on Oct. 1 will take up the duties of works manager at the plant of the Hartford Special Machinery Co., of Hartford, Conn.

LEON W. GRAHAM, for the past 13 years paymaster for the Greenfield Tap & Die Corp., Greenfield, Mass., has been elected assistant treasurer of the concern.

GEORGE K. SCHIELDGE, works manager of the Hartford Special Machinery Co., Hartford, Conn., has resigned that position and will devote his entire time to the management of the Stacy Machine Works, Springfield, Mass., of which concern he is part owner.

WILLIAM IVES will be in charge of the recently opened sub-office of the Baltimore branch office of the Westinghouse Electric & Manufacturing Co., at Norfolk, Va.

J. E. HAUSER will be in charge of the newly opened Toledo office of the United States Electrical Tool Co., Cincinnati. The Toledo office will be located at 110 and 112 Eleventh St.

Obituary

JOHN EDWARD SNYDER, senior partner of the firm of J. E. Snyder & Son, Worcester, Mass., died on Aug. 25. Mr. Snyder was one of the early builders of vertical drilling machines and was a well-known figure in the machine tool industry in New England. The business will be continued by his son Milton C. Snyder, the junior member of the firm.

DANIEL BEST, aged 85 years, founder of the Best Manufacturing Co., San Leandro, Calif., died recently in that city.

EDWARD L. MILLS, president of the Mills Iron Works of Los Angeles, Calif., manufacturing oil well tools, died at his home in that city Aug. 20. He was born in Williamsport, Pa., Oct. 29, 1869.

JOSEPH BAKER, aged 77 years, pioneer foundryman of Belleville, Ill., and proprietor of the Baker Stove Works, died in that city following a long illness.

J. M. WOOD, superintendent of the Knoxville Iron Works, Knoxville, Tenn., died recently in that city following an attack of heart disease. Mr. Wood was 64 years of age and had been with the Knoxville Iron Works for several years.

WILLIAM WILLIAMS, general superintendent of the Interstate Iron & Steel Co., of East Chicago, died suddenly when stricken with apoplexy.

Business Items

Bannon & Suit, with general offices located in the Masonic Temple, Raleigh, N. C., is the name of a new company that has recently been formed by George C. Bannon and Arthur M. Suit, to engage in the machinery distribution business, and the general distribution of equipment used by contractors and builders. The company also maintains a warehouse at Raleigh. George C. Bannon for some time has been connected with the Austin Machinery Corp., of Toledo, O., as a sales engineer, while Mr. Suit has been with the same company as assistant to the president.

It has been recently announced by Evan J. Owen, president of the Eureka Foundry Co., of Gadsden, Ala., that the company has decided upon a program of expansion to be carried out this year, the plans including general improvement and enlarging of the plant, its capacity to be materially increased as a result. The investment will amount to several thousand dollars.

Ground is to be broken at once for the new $3,000,000 print paper plant to be built on Ronawanda Island, near Buffalo, by the Daily News Print Corp., allied with the Canadian Paper Co., at Thorold, Ont., Canada. The machine room of the new plant will be 380x93 ft., the beater room 145x130 ft. The main building will be 400x150 ft.

The Detroit office of the New Britain Machine Co., New Britain, Conn., has been moved from the Garfield Building to the General Motors Building.

The Standard Turbine Corp., Wellsville, N. Y., announces that it has appointed the Percy E. Wright Engineering Co., in the L. C. Smith Building, Seattle, Wash., as its Seattle representative.

Plans to merge the Springfield Malleable Iron Co. of Springfield, Mass., with the Arcade Malleable Iron Co. division of the Baldwin Chain Manufacturing Co. of Worcester, Mass., have been announced. The Springfield plant will retain its name, but the main offices will be in Worcester. The concern will take over the foundry end of the Baldwin operations. Capitalization will be increased to more than $1,000,000. Henry P. Blumenauer will continue as president and manager. The Springfield Malleable Iron Co. was formed last Spring, when the foundry of the Harley Co. was bought from the Hendee Manufacturing Co. The plant is devoted to manufacture of brass, bronze, aluminum and malleable iron castings.

Stockholders of the Oneida Motor Truck Co., Green Bay, Wis., have accepted the proposition of L. W. Melcher, formerly its general manager, and his associates, to take over the entire assets on condition that approximately $500,000 of mortgage bonds be cancelled and bondholders accept from 50 to 85 per cent of the face of bonds in stock in a new corporation, according to the classification of their holdings. The Oneida Mfg. Co. already has been incorporated in Wisconsin with $500,000 capital by Mr. Melcher. In addition to continuing the manufacture of motor trucks, the new company will enter the field of gasoline railway coaches and cars, and wood and metal specialties.

The Ford Motor Co. has ordered from the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., four 4,500 kva., 13,200 volt, three phase, 60 cycle, 72 pole, 100 r.p.m. vertical waterwheel generators with thrust bearings and direct-connected exciters. The order was placed through the Stone & Webster Co., Inc., contractors.

The generators will be installed in the hydro-electric station of the Twin City plant of the Ford Motor Co. at St. Paul, Minn. Much of the power from this station will be used for industrial purposes in the Ford plant and the rest will be sold to the public for general utilities.

The Machinery Warehouse Co., Inc., Chicago, is now one of the largest and best equipped machinery warehouses in the country. This company recently leased 225,000 sq.ft. of floor space of Harris Brothers, in the Symington gun plant at 74th St. and Ashland Ave. The entire floor space of the new warehouse is covered by eight overhead traveling cranes with a lifting capacity of from ten to twenty-five tons.

The Quality Grinding Co., Inc., of Springfield, Mass., has taken over the cylinder grinding and motor specialties business of the Charter Oak Machine Co. of Hartford, Conn., and will continue operations at 173 Chestnut St., Springfield. Clifford Loud heads the concern, Harvey S. Godbout is treasurer and Leander Hoppe sales manager.

The prizes offered each year by Alvan T. Simonds, president of the Simonds Saw & Steel Co., Fitchburg, Mass., for the best essays on economic intelligence were this year awarded to John J. Borchardt and Morris Saltzman, both of Brooklyn.

At the annual meeting of the Ontario Steel Products Co., Toronto, the following officers were elected for the year: President, W. Wallace Jones, Toronto; vice-president, W. T. Sampson; secretary-treasurer, Ford Petch; directors, W. Wallace Jones, W. T. Sampson, F. P. Jones, H. M. Jaquays, D. Ford Jones, J. T. Richardson, Kenneth Molson, Capt. N. C. Jones and Dr. C. H. Bird.

A further order for a half million dollars' worth of equipment for the new super-power plant to be erected in Kearney, Ontario, by the Public Service Electric Power Co., has been placed. It includes nine fifteen-retort Riley stokers, to be manufactured by the Sanford-Riley Stoker Co., of Worcester, Mass., and six sixteen-retort Taylor stokers, which will be supplied by the American Engineering Co. of Philadelphia.

The Marvel Equipment Co. of Cleveland, Ohio, has definitely decided to locate its Canadian branch in Belleville, Ontario, and has secured factory space. This company will at first manufacture only its line of gasoline pumps, in Canada, but will later add steel drums for carrying gasoline, oil and alcohol, as well as other allied equipment.

The Ford Motor Co. expects to occupy its new plant in Toronto by the end of September. The factory when completed will be one of the largest in Toronto, the main building covering an area of 5½ acres, while the entire establishment covers an area of 15½ acres. The plant which cost approximately $1,500,000, will be used chiefly for assembling purposes.

Recent Export Achievements Show Conditions Improved

FOR the first time since February, the exports of the United States exceeded the imports during the month of July, according to reports recently issued by the Department of Commerce. For the first seven months of the year, the imports exceed the exports by $115,990,383 which the alarmists take as a sure sign of ruination, but which actually means that conditions are fairly good in this country and that as long as we remain a creditor nation rather than a debtor nation we must expect to receive more goods from other countries than we are able to sell to them.

With the domestic problems well in hand manufacturers in every part of the country are turning their attentions to markets in other parts of the world. It has been pointed out by far-seeing economists that while Germany and France do not offer attractive features for selling at the present time, all the rest of the world is in a receptive mood for goods. England, Spain, the northern countries of Denmark, Sweden and Norway, and Italy are all in the market with good credit and sound currency. Russia has recently been considered a factor in the export business and many manufacturers are watching eagerly the outcome of the Soviet rule in re-establishing commerce. South America is in a much better condition than it has been for some little time and are purchasing all sorts of goods from the United States. The markets are being well developed by the progressive manufacturers of the United States.

Building Good-Will

An interesting note recently in a bulletin of the Department of Commerce stated that in Yucatan there were 10,000 typewriters and all of them of American make. Indeed, 90 per cent of them were one particular make, showing what can be done by building up good-will for your product.

During July the Argentine bought 73,000 rolls of wire from the United States as compared with 1,700 rolls from Germany and 1,300 from all other countries. Six thousand cases of sewing machines were received from the United States, while 639 cases came from Germany and 22 cases from other countries. The United States sold to the Argentine 562 cases of typewriters, Germany sold 109, and all other countries sold 47 cases. These figures show that the United States can lead in most specialties and that the sales are made upon "quality talks" alone, as prices differ considerably with the highest prices being charged by the United States in most instances.

Export houses in New York City have stated that business has been much improved as compared with last year, but that there is still room for improvement in the machine tool line. They state that hardware and hardware specialties have been in big demand this year but that, undoubtedly due to Ruhr Valley occupation, the call for machine tools in Europe has not been as large as was expected.

However, according to the Department of Commerce reports, France seems to be partially recovering from her recent financial illness and to be slowly on the way to recovery.

"The trend of developments in France during the month of July was favorable," states the report, "notwithstanding seasonal calmness and the instability caused by political developments and exchange fluctuations. Government receipts were in excess of the estimates; railroad receipts were above those of last year; agricultural prospects were promising; woolen and cotton textiles normal; the condition of the chemical industry was satisfactory; the production of iron and steel was larger; foreign trade was active; and the index of the cost of living decreased. Unemployment was negligible."

Industrial Census for Switzerland

Switzerland in spite of being commonly called a land of hotel keepers, is essentially an industrial country. Light and heavy machinery, fire arms, automobiles and watches and clocks form a considerable part of its industrial wealth and money of exchange.

The government has announced that there will be carried out shortly a complete census of Swiss industrial plants. The last so issued was in 1911. In view of the events during the world war and the still more potent events of the attempt at a world peace, Switzerland, one of the important buffer states of western Europe, has felt the beating of the political pulse far more tangibly than some of the former belligerants.

Such partial figures as are already available indicate that from 1911 to 1918, covering the war period, Swiss industrial plants increased 19.6 per cent but that from 1918 to 1922, the aftermath of war period, they decreased 13.5 per cent.

At the end of 1922 there were 8,054 industrial plants in Switzerland, a number virtually equal to that of 1911 but a considerable decrease from that of 1918.

Fewer Metal Working Shops

This diminution in the number of active industrial plants varies notably as to their product, the greatest falling off being among the metal working industries, a recorded loss of 314 establishments being noted since 1918. The woodworking industries are in a similar relative position. The clock and watchmaking and jewelry industries note a loss of 249 establishments during the same period. The group accounting for "machinery and instruments" indicates a loss of 119 units.

Those industries the most in default are those that are directly dependent upon raw or semi-raw materials from abroad. Those industries where the raw material is of a less cumbersome or heavy nature and coming from near by sources of supply have suffered the least. Transport costs are considered a factor in producing this situation.

The clock and watch making trade has suffered the most during the past four years, that of Neufchatel having lost 21 per cent of its enterprises, that of Geneva 29.2 per cent and the Vaud 31 per cent.

News of Washington Activities

By Paul Wooton

F. R. Wadleigh, Federal Fuel Distributor, returned to Washington from New York where he conferred with governors and their representatives of the Eastern anthracite - consuming States regarding plans for supplying substitutes in the event of a cessation of anthracite shipments well satisfied with the reception given the plan and the co-operation pledged. He devoted the remainder of the week to quietly perfecting various details of the plan.

The members of the Coal Commission devoted several days during the week to consideration of their report on bituminous coal, which is to be submitted on or before Sept. 22, the date on which the Commission will expire by limitation. Reports from the staff on various phases of the soft coal question were studied.

The Commission made public on Aug. 30 a statement on pyramiding middlemen's profits in anthracite, which was mentioned briefly in its report of July 5. Competition maintains low prices by wholesalers and jobbers in normal times, this report stated, but in periods of panic, or seller's market, there is a tendency for wholesalers to speculate among themselves with hard coal, thus adding several margins to a single shipment. In its inquiry on this subject, the Commission traced 750 carloads of anthracite as handled last year during the strike. More than half passed through the hands of only one wholesaler at margins varying from 20 cents to $3 per gross ton, the majority being 50 cents to $1.25. A number of cars, however, passed through more than one middle transaction, some as many as four, with total margins of 25 cents to $4.75 per ton.

Detailed figures showing the f.o.b. mine price of stove anthracite, including freight, to retail dealers in a number of towns and cities of New York, Pennsylvania, New Jersey, Maryland, Delaware, Ohio, Indiana, Wisconsin and Michigan, and Washington, D. C., as gathered last Spring, were made public by the Commission.

Abolishing Gunmen

A committee representing the United Mine Workers filed with the Coal Commission a statement making charges that gunmen employed by operators in non-union fields had assaulted union sympathizers. The Commission was asked to make a declaration against the armed guard system.

In connection with its request for the check-off in the anthracite field, the United Mine Workers issued in Washington a statement asserting, through a letter written by B. N. Jewell, president of the railway employees department of the American Federation of Labor, that dues are collected by railroad companies which have "company unions" among their employees.

As a step in preparation for eventualities, the Bureau of Mines issued a statement by O. P. Hood, chief mechanical engineer, on the use of substitutes for anthracite coal.

The Federal Fuel Distributor, F. R. Wadleigh, issued the monthly statement of stocks of bituminous coal, prepared by the Geological Survey and the Department of Commerce, which showed that approximately 51,000,000 tons of soft coal were in storage piles on Aug. 1, an increase of 5,000,000 tons as compared with July 1 and higher than at any other date for which records are available, excepting only at the close of the war and just prior to the strike of 1922.

Stocks of anthracite in consumers' bins or dealers' hands as of Aug. 31 were estimated by various governmental agencies as approximately 25,000,000 tons.

Comparative Prices of Shop Supplies

Average of New York, Chicago and Cleveland Prices

	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0337	$0 0337	$0.0285
Cold finished shafting	per lb.	0.0433	0.0428	0.0365
Brass rods	per lb.	0.17	0.1825	0.17
Solder (½ and ¼)	per lb.	0.276	0.276	0.225
Cotton waste	per lb.	0.1225	0.1231	0.1458
Washers, cast iron (⅛ in.)	per 100 lb.	4.66	4.66	4.00
Emery, disks, cloth, No. 1, 6 in. dia.	per 100	3.08	3.08	2.96
Lard cutting oil	per gal.	0.575	0.575	0.575
Machine oil	per gal.	0.349	0.349	0.36
Belting, leather, medium	off list	37%	37%	44⅓%
Machine bolts up to 1x30 in.	off list	49½%	44¼%	53⅛%

Railroad Earnings For Seven Months

Class One railroads of the United States, according to reports from 193 roads representing a total mileage of 235,670 miles, in July earned an annual rate of return of 4.93 per cent on their tentative valuation as fixed by the Interstate Commerce Commission for rate making purposes including additions and betterments up to Jan. 1, 1923.

This rate represented a net operating income for the month of $84,591,400. In the Eastern district the rate earned was 5.60 per cent; the Southern district, 5.26 per cent; and the Western district, 4.05 per cent.

These tabulations are based on reports filed by the carriers with the Interstate Commerce Commission and tabulated by the Bureau of Railway Economics.

In July last year, the same carriers earned a net operating income of $69,321,000, which was at the annual rate of return of 4.12 per cent. In June this year the rate was 5.47 per cent.

In considering the earnings of the Class One carriers in July, account must be taken of the strike of railway shopmen which began on July 1 last year, at which time the coal miners strike was in progress. It was also on July 1 last year that a reduction of about 10 per cent in freight rates went into effect, thus placing on a comparable basis for the first time in months the earnings of the Class One carriers in July this year with those for the same month in 1922.

Twenty-nine Class One railroads in July operated at a loss, of which eight were in the Eastern district, five in the Southern and sixteen in the Western district.

Operating revenues of the carriers in July totaled $535,577,300, an increase of $91,870,000 or 20.7 per cent over the same month last year, while operating expenses amounted to $414,333,300, an increase of $73,377,100, or 21.5 per cent over July last year.

For the first seven months this year the net operating income of the Class One railroads represented an annual rate of return of 5.51 per cent on their tentative valuation amounting in dollars to $528,219,300, compared with $418,394,650 or 4.46 per cent for the same period in 1922, or an increase of $109,824,650 over the first seven months last year. In the Eastern district for the first seven months it was 6.40 per cent or $288,484,000; in the Southern district 6.47 per cent or $77,624,750, and in the Western district 4.17 per cent or $162,110,550.

Will Survey Industrial Eyesight Condition

A nation wide survey of eyesight conditions in American education and industry has been undertaken by the Eye Sight Conservation Council of America, it is announced at the national headquarters of the Council.

As to industry, the aim of the survey, according to Guy A. Henry, general director of the Council, is to disclose the relation between defective vision and the efficiency of the nation's millions of workers. As to education, it is purposed to ascertain what steps have been taken by the schools to measure the extent of poor eye sight.

The Eye Sight Conservation Council's survey, marking the start of the research program recently adopted by the Board of Directors, has set out to reveal the effect of incorrect vision upon production. It has prepared a questionnaire designed to show increase in individual performance, decrease in accidents, increase in production and decrease in spoilage. The extent of color blindness, the number of blind in one eye, the number totally blinded, hours lost due to eye accidents, equivalent wages for lost time, use of goggles, cost of eye protection service, and total number of eye injuries are other objectives.

The Business Barometer

This week's outlook in Commerce, Finance, Agriculture and Industry based on current developments

By THEODORE H. PRICE
Editor, *Commerce and Finance*, New York

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WHILE organizing actively and giving lavishly for the relief of the grievously stricken people of Japan, American business men have come to agree with Edmund Vance Cooke that—

A trouble's a ton,
Or a trouble's an ounce,
Or a trouble is what you make it;
And it isn't the fact that you're
hurt that counts,
But only how did you take it.

By acting on this sentiment the depression that the Japanese disaster might have caused was averted and the markets are generally firm as the week ends. It is about the clearest case of "mind cure" on record, for the precedents were nearly all against it as pointed out by a distinguished "propheteer" who has been noisily predicting a decline ever since the markets touched bottom last June.

But the fact is that the destruction of property caused by war, fire or earthquake is not a bearish influence if the losers are plucky and have the energy required for reconstruction.

Everything that men make is made to be consumed or used up and when the consumption is rapid or the use intensive we say business is good. An earthquake or a fire only hastens the natural and inevitable disappearance of consumable or usable things and the production of others to take their place.

This explains the prosperity that is the result of war and the accelerated activity that has already followed the earthquake in Japan. The large stock of silk in Yokohama has probably been destroyed and that held in other parts of the world is very much higher and hard to buy at any price. One result has been a greatly augmented demand for artificial silk. Other articles somewhat affected are rice and tea, both of which are firmer. The demand for American rice is expected to increase and it is feared that the supply of Japanese tea will be curtailed.

Since the earthquake the Japanese have been large buyers of American cotton, presumably to replace the stocks destroyed at Yokohama, for the cotton mills of Japan were mostly outside the earthquake zone. Steel, copper, zinc, and tin are all firmer, and it is expected that Japan will buy largely when the work of reconstruction starts, as it is expected to shortly.

By stressing these aspects and probabilities optimism has been encouraged and despite the terrible loss of life the people of Nippon and America have joined hands in a determination to make tomorrow better than yesterday in the land of the Rising Sun. In so far as Occidental capital is concerned the losses it will sustain are chiefly confined to the claims that the marine insurance companies will have to pay. They are said to be large, but not crushing, and the fire companies will lose but little as most of them were protected by the earthquake clause.

Looking elsewhere over seas the view is also more cheerful than it was a week ago. Germany is showing a disposition to climb down, and France, looking at Mussolini is commencing to see herself as others see her. The revelation is not altogether to her liking and there is evidence that Poincare is also becoming a little more reasonable.

Italy and her truculent Premier continues to protest that the League of Nations has no jurisdiction over her private quarrel with Greece, but as England and France take the opposite view and can enforce it by economic coercion it is unlikely that Mussolini will defy them if it comes to a showdown. The fact is that all the nations of Europe except Great Britain got in the habit of aggressive self assertion during the war. It may take them some time to change but as it is plain that none of them really wants to fight, America is ceasing to be alarmed by their bluster.

> "Meantime all the other domestic omens are favorable and it is threshing old straw to report record car loadings, good railroad earnings, increased sales at the department stores and by mail-order houses, and conditions that are reasonably satisfactory everywhere. . . . On the Stock Exchange speculation is still somewhat lethargic, but the undertone is good. Bear raids are ineffective and the probabilities seem to favor a gradual rise in prices."

The foreign situation has been treated at such length because there is nothing at home that calls for notice except the anthracite coal strike.

By the time this is printed that may be settled, for Governor Pinchot really seems to be bringing the men and the operators together. But even if he fails the result will not be serious, for enough bituminous coal and oil are now in sight to keep the whole country comfortable and the anthracite monopolists might see a great light if their product fell into desuetude for one Winter.

Meantime all the other domestic omens are favorable and it is threshing old straw to report record car loadings, good railroad earnings, increased sales at the department stores and by the mail order houses, and conditions that are reasonably satisfactory everywhere. Wheat is firm. Cattle, hogs and hog products are higher; coffee and sugar are steady but featureless, and the only market that has been doing stunts is cotton, in which there is a broadening speculation upon the theory that the last Government crop estimate is correct. If it is much higher prices will probably be recorded before the season ends, but as the market ascends toward thirty cents the altitude becomes dangerous and the adventurous aeronauts should be on the lookout for what they call airholes.

But the cotton goods market is active and advancing. The European spinners, as well as our domestic manufacturers, have got to buy promptly or miss getting their quota out of a small crop, and at or around 25 cents their purchases will probably stop any decline.

On the Stock Exchange speculation is still somewhat lethargic, but the undertone is good. Bear raids are ineffective and the probabilities seem to favor a gradual rise in prices.

The Federal Reserve Banks lost $19,000,000 in gold last week. Just where it went to is not apparent. Probably it was paid out in "yellow backs." Increases of $34,600,000 in the holdings of discounted bills and $32,500,000 in Federal Reserve note circulation reflect the seasonal expansion that is to be expected at harvest time. The reserve ratio is lower at 76.4 per cent as compared with 77.5 last week, but none of the changes are significant. The Federal Reserve Bank Notes, of which there were $53,000,000 in circulation this year, are now down to $509,000.

But the reduction will interest no one but the bankers, and the most important inference to be drawn from the Bank statement is that there is plenty of credit to finance a continued expansion in business.

First Motor Transport Congress in May

Delegates from 114 countries of the world will attend the first International Motor Transport Congress that will be held in Detroit next May, according to announcements just made.

The purpose of the Congress is to provide a better understanding of the economic factors underlying motor transportation in every part of the world. The Congress is under the auspices of the National Automobile Chamber of Commerce. A program for four days is being prepared and it is expected that it will have a wide range of subjects that are of interest to the many different classifications that will be represented at the Congress.

Financial Status of Stevens-Duryea

In a report filed in Superior Court in Springfield, Mass., Sept. 4, by Harry G. Fisk and Frank H. Shaw, receivers for Stevens-Duryea, Inc., the financial condition of the company as of July 31, 1923, is given as follows: Assets as per statement of assets, $469,743.72; cash on hand and in banks, $17,537.74; accounts and notes receivable, $9,050; total assets, $516,322.46. Liabilities: Accounts payable and commitments, $18,410.67; assets taken over from Stevens-Duryea, Inc., May 9, 1922, $387,003.47; net gain from operation, $110,908.32; total liabilities, $516,322.46. The report states that the assets, excluding cash and receivables, carried on the company's books as of May 10, 1922, when the receivership was instituted, aggregating $3,983,212, were valued too high by $1,087,363.

On July 1, 1922, the receivers reported a fair value of $1,243,262 as a going concern and $337,080 as a value under forced litigation. These figures have since been scaled down. Whereas the receivers then assumed, the report says, that the Stevens-Duryea car as then produced was a finished and satisfactory product, it has since learned that further engineering work was needed, and that at least four important units could be purchased complete with more satisfactory results than from those that were being incorporated in the car.

The report tells of large economies made in operating the plant under the receivership. It will be necessary to borrow considerable money to continue the plant in operation, the report says, and unless a sale can be effected in the immediate future the receivers advise that the plant be closed and prepared for liquidation. The receivers' recommendation that the plant be sold for $450,000 will come up in Superior Court Sept. 15.

Gary Holds Meeting of Company Heads

The presidents of the subsidiary manufacturing companies of the United States Steel Corp., held another meeting recently in the offices of Elbert H. Gary, chairman of the board of directors, for the purpose of discussing an equitable adjustment in wages in connection with the elimination of the twelve-hour day. A similar meeting was held last week. Following the meeting Mr. Gary issued the following statement:

"The presidents of the various manufacturing subsidiaries of the United States Steel Corp., held a meeting for the adjustment of wage rates. We have nothing to publish at this time. The readjustment is going on satisfactorily and without serious friction and nothing should be said to disturb our relations with the men."

According to information obtained the conferences are being held for the purpose of adjusting the wages of employes not affected by the increase announced at the time the American Iron and Steel Institute declared that the twelve-hour day would be abolished in the steel industry and that the men whose working hours were reduced from twelve to eight hours a day would receive an increase of 25 per cent in wages. This wage adjustment did not effect the men in other than the 'continuous operations plants" whose working hours were reduced from twelve to ten hours, nor did it affect common labor in other plants.

Studebaker Output Record Broken

The Studebaker Corp. broke all production records last month, when 15,700 cars were produced, according to a statement issued yesterday by A. R. Erskine, president of the company. "Production for the eight months ended Aug. 31, 1923, was 110,540 cars," he said, "against 78,369 cars in the same period last year. The production of eight months this year exceeds the production of 109,222 cars for the full calendar year of 1922.

"Sales are absorbing production, totaling about 30,000 cars for the first two months of the current quarter, compared with 30,199 cars for the full third quarter last year. The total stock of cars in dealers' hands is less than it was last May, and the indicated Fall demand is strong. The total sales of the last four months will be all gain as compared with last year. The management expects sales to top 150,000 cars this year, as against 110,269 last year."

Pennsylvania Shows Big Increase

Increases in both net and gross revenues for July as compared with July of last year were shown in the reports of the Pennsylvania System issued recently.

The Pennsylvania System reported total operating revenues of $69,669,185, an increase of $13,649,120. By far the biggest increase was shown in freight revenues, which totaled $46,292,215, or $11,699,252 more than the year before. Expenses also showed an increase over the previous July. In this connection the early work done on shop repairs by the system was an important factor.

Total expenses amounted to $55,552,188, an increase of $8,733,269. Increases of $4,288,274 in maintenance of equipment and $3,445,663 in transportation were the chief items of increase on this side of the ledger. The system's net revenue from operations amounted to $14,116,997, an increase of $4,915,851, and net operating income was $8,712,102, an increase of $3,971,919.

Plan Large Exhibit of Electric Foundries

Over a million dollars worth of equipment will be on display in the Broadway Auditorium, Buffalo, when the Association of Iron and Steel Electrical Engineers holds its steel exposition from Sept. 24 to Sept. 28. A complete electric foundry will be in operation producing finished castings. Business sessions of the association will be held at the Hotel Statler and the program is replete with technical subjects that are of vital interest to men in this line of work.

John F. Kelly is the national secretary of the association with headquarters in the Empire Building, Pittsburgh, Pa. Further and more detailed information may be received from him.

Another Record for Car Loading

Car loadings throughout the United States for the week of Aug. 25, reached 1,069,932, a new high record for all time. This exceeds by 28,888 cars the previous record, which was established during the week ended July 28 last, when 1,041,044 cars were loaded. This also exceeds by 51,393 cars the record of 1,018,539 established in the week of Oct. 14, 1920, and which stood until this year.

Besides a new high record in total cars loaded the number of merchandise and miscellaneous cars loaded reached 606,105, a new record.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

Automobile accessories for small-type cars. Lwow, Poland. Purchase and agency. Reference No. 7604.

Automobile accessories. Zagreb, Yugoslavia. Purchase and agency. Reference No. 7626.

Automobile accessories and motors for industrial purposes. Reval, Esthonia. Agency. Reference No. 7587.

Machine shop and foundry equipment and replacements. Riviere du Loup, Canada. Purchase. Reference No. 7605.

Compressed air and vacuum pumps. Antwerp, Belgium. Agency. Reference No. 7577.

Gasoline pumps. Zagreb, Yugoslavia. Purchase. Reference No. 7635.

Steel-working tools. Antwerp, Belgium. Agency. Reference No. 7577.

Wooden pipe-making machinery. Antofogasta, Chile. Purchase. References No. 7611.

Forthcoming Meetings

New Haven Branch of the American Society of Mechanical Engineers. Third annual machine tool exhibit Sept. 18, 19, 20 and 21. Mason Laboratory, New Haven, Conn. A. C. Jewett, chairman.

Association of Iron and Steel Electrical Engineers. Iron and steel exposition, Buffalo, Sept. 24 to 28. John F. Kelly, secretary, Association of Iron & Steel Electrical Engineers, 708 Empire Building, Pittsburgh, Pa.

National Safety Council. Twelfth annual congress at Buffalo, N. Y., Oct. 1 to 5. All meetings will be held at the Statler Hotel. Headquarters, 168 No. Michigan Ave., Chicago, Ill.

American Society for Steel Treating. Annual convention at Pittsburgh in connection with the International Steel Exposition, Oct. 8, 9, 10, 11 and 12. W. H. Eisenman, 4600 Prospect Ave., Cleveland, Ohio, national secretary.

Society of Automotive Engineers. Production meeting at Cleveland, Ohio, Oct. 25 and 26. Headquarters, 29 West 39th St., New York City.

American Gear Manufacturers Association. Fall meeting. Mountain House, Lake Mohonk, N. Y. Oct. 25, 26 and 27. T. W. Owen, secretary, 2,443 Prospect Ave., Cleveland, Ohio.

American Management Association. October 29, 30, and 31, Hotel Astor, New York City.

National Exposition of Power and Mechanical Engineering. Second annual exposition to be held at the Grand Central Palace, New York City, Dec. 3 to 8. Headquarters, Grand Central Palace, New York City.

New and Enlarged Shops

Machine Tools Wanted

Md., Cumberland—M. McKaig—grinding machine to cut various sized bits from bar stock, capable of grinding them on surface and angles (new or used).

Mass., Woburn—J. J. Grothe Co., 12 Everett St. (manufacturer of wagons)—wood and metal working machinery for addition to plant.

Mass., Worcester — J. Nagle, Harrison St.—machinery and equipment for proposed machine shop.

Mich., Detroit—Knight Screw Products Co., 6510 Epworth Blvd.—automatic screw machine.

Mich., Highland Park (Detroit P. O.)—C. B. Shepard Co., 89 Moss Ave.—700 to 1,000 ton hydraulic press (used preferred).

Mich., Union City — Ford Garage Co., Engle & Stanton, owners—complete equipment for proposed $75,000 garage and service station.

N. Y., Binghamton—McGill Machine Co., 46 Commercial Ave., C. E. McGill, Purch. Agt.—machinery and equipment.

N. Y., Binghamton—P. J. McManus & J. T. Buckley, 85-87 Henry St.—equipment for service station and garage.

N. Y., Buffalo—M. Minor, 242 Kingsley St.—metal spinning lathe with swing of 28 or 30 in. circle.

N. Y., Jamestown—King Motor Sales Co., West 4th St., H. C. King, Pres.—complete garage and service station equipment, including lathes, turntable, pumps and machine shop equipment (will be in market by Nov.).

N. Y., Jamestown—Telt's Motor Co., 501 Foote Ave., C. G. Telt, Purch. Agt.—equipment for proposed machine shop and automobile service station.

N. Y., New York—Davis Equipment Co., Inc., 50 Church St., W. E. Davis Purch. Agt.—car wheel press, capacity 200 ton or over, 48 in. or over between bars; portable crank pin press with 12 in. stroke or ram, 200 ton capacity, 24 to 56 in. between bars, complete with resistance head with 8 in. open for shaft on axles.

N. Y., New York—Forsberg Electric Mfg. Co., 100 West Houston St.—milling machine.

N. Y., Niagara Falls—T. H. Routh, c/o Walkers Repair Shop, Furgeson and Muir Sts.—machine shop equipment.

N. C., Raleigh—J. W. Evans, East Morgan St.—machinery and equipment for proposed $50,000 automobile and general repair shop.

O., Columbus—Columbus Bolt Co., Water and Chestnut Sts., H. S. Mason, Purch. Agt.—medium size drill press and grinder.

O., Columbus—Martin Krumm Co., 330 South 4th St. (manufacturer of iron fence and gratings), H. L. Krumm, Genl. Mgr.—metal working machinery and one small lathe.

R. I., Providence—H. Fisher, Tribune Bldg.—complete machine shop equipment for automobile repairs.

W. Va., Northfork—Community Garage, S. S. McNeil, Pres.—machinery and equipment for proposed service station.

Wis., Milwaukee—R. Rutzen, 401 Gladstone St.—bench tools, vises and pattern maker's lathe, medium size.

Wis., Neenah—Valley Inn Buick Co., c/o J. O. Kuehl, 108 West Wisconsin Ave.—20 to 22 in. drill press and one emery grinder.

Wis., Racine—M. Lawson, 401 Lake Ave.—automobile repair machinery, gasoline tanks and pumps for proposed garage.

Wis., Sturgeon Bay—Peterson & Egeland Mfg. Co. (manufacturer of electric motors), G. R. Egeland, Purch. Agt.—tool room lathe, small drill press and bench tools.

Que., St. Agathe des Monts—M. Paquette—garage equipment.

Que., St. Angele de Laval—Deshaies & Deshaies—automobile repair shop equipment.

Que., St. Hyacinthe—J. B. Gervais, 59 Cascades St.—automobile repair shop equipment.

Que., St. John's—A. E. Gregoire, 35 Champlain St.—pump and repair equipment for garage.

Que., Ste. Martine—R. Laberge—garage and repair equipment.

Que., Sutton—E. H. Eastman—drill press for automobile repairing.

Que., Yamaska—A. Cartier—lathe, drills, emery wheel, jacks, etc., for garage.

Machinery Wanted

Ark., Marianna—Courier-Index—7 column newspaper folder.

Conn., Vernon—Bd. Educ.—wood and metal working tools and equipment for new high school.

Ia., Dubuque—Adams Co., 295 6th St.—plating outfit.

Kan., Baxter Springs — Baxter Springs Citizen, R. L. Strader, Purch. Agt.—job printing press with Miller feeder, saw trimmer and paper cutter (used preferred).

Kan., Pittsburgh—Hull & Dillon Packing Co.—acetylene welding outfit and cutting machine.

Ky., Lexington—Oil Products Co., Inc., 5th and Jefferson Sts.—3,000 gal. gasoline rotary pump and four 12,000 gal. gasoline tanks.

Md., Baltimore—Standard Electric Mchy. Co., 7-9 East Hill St.—1½ or 2 ton monorail hoist, 3 phase, 60 cycle, 220 volt, with or without trolley.

Md., Frederick—Price Bros.—6 spindle drill and one punch capable of blanking a disc, 4 in. diameter and ⅛ in. thick.

Mass., Boston—W. Carter Co., 77 Summer St. (manufacturer of woolen and cotton cloth)—equipment, scales, furnaces, looms, etc., for proposed additions and replacements for Collier Mills, Barnesville, Ga.

Mass., Brighton (Boston P. O.) — H. Easter, 154 Bigelow St.—two job printing presses, about 10 x 15 in.; also paper cutter, type and cases.

Mich., Manton—Manton Tribune—newspaper folder.

Mich., Menominee — Lloyd Mfg. Co., North State St.—woodworking machinery for proposed $75,000 addition to factory for the manufacture of baby carriages.

Mo., Kansas City—Deaner Institute, 3520 Bway., P. M. Orlopp, Purch. Agt.—Universal woodworking machine.

Mo., Mountain View—J. H. Patten (job printer)—paper cutter.

N. Y., Binghamton—Cutler Ice Co., Front St., I. Thomas, Pres.—equipment for proposed $50,000 ice plant, 30 ton capacity.

N. Y., Binghamton—Klein-Powell Shirt Co., 178-182 Water St., J. C. Klein, Purch. Agt.—machinery and equipment for new plant.

N. Y., Buffalo—Dahlke Stationery & Mfg. Co., 208 Washington St., B. A. Dahlke, Purch. Agt.—stationery and printing equipment for new plant at 102 Carroll St.

N. Y., Buffalo—Jeffrey-Dewitt Insulator Corp., Abbott Rd. and Buffalo River, J. E. Sinclair, Genl. Mgr.—equipment for the manufacture of high tension switches.

N. Y., Buffalo—Niagara Steel Wire Co., Inc., 638 4th St., C. S. Madison, Purch. Agt.—equipment for the manufacture of steel wire for new plant on Lakeview and Porter Aves.

N. Y., Buffalo—Reed Press, 56 Cottage St., H. Reed, Purch. Agt.—printing equipment for plant at 409 Niagara St. to replace that which was destroyed by fire.

N. Y., Cohoes—Little Falls Fibre Co., Northside, M. F. Stack, Supt.—eight sets of cotton cards, one lapper and one condenser.

N. Y., Cincinnatus—Reid Creamery & Ice Cream Plant—$20,000 worth of equipment for proposed plant, to replace that which was destroyed by fire.

N. Y., Jamaica—J. A. McCarthy, 14716 Jamaica Ave.—nickel and copper plating equipment.

N. Y., Johnson City—Ideal Caramel Co., Willow St. and Grand Ave.—machinery and equipment for proposed addition to plant.

N. Y., New York—Hunt Dodge Co., 405 Lexington Ave.—electric drill for cutting concrete.

N. Y., New York—Quick Service Printing Co., 411 East 5th St.—one multicolor press, 12 x 18 in.

N. Y., New York—Universal Can Co., J. F. Montgomery, c/o Nestle Food Co., 130 William St., Purch. Agt.—machinery for the manufacture of specialized milk machinery and dairy products for plant at Hiresdale.

N. Y., Saratoga Springs—Baker Mfg. Co.—equipment, including one 10 ton crane, for proposed $50,000 foundry.

N. C., Lexington—Cascade Mills, Inc., 306 North Main St., A. F. Bruton, Pres.—7,000 spindles and 400 looms for mill at Mooresville.

O., Chillicothe—Buckeye Tile Co., J. E. Hydell, Genl. Mgr.—tile working machinery, including mixer and press.

O., Cleveland—Cleveland Heater Co., Locust Ave. and West 112th St.—one tinners' roll, 60 in. capacity.

O., Cleveland—Cleveland Times, 307 Superior Ave., O. K. Shimansky, Purch. Agt.—model No. 1 linotype.

O., Cleveland—New York, Chicago & St. Louis R.R. Co., Columbia Bldg., W. P. Dittoe, Purch. Agt.—electric hoists, buckets, etc., for proposed coaling station at Conneaut.

O., Columbus—Columbus Coffin Co., Buttles St. and Ingleside Ave., E. Y. Clark, Genl. Mgr.—woodworking machinery to enlarge plant.

O., Girard—Persing Milk Products Co., State and Kline Sts.—ice cream making machinery for proposed $50,000 plant.

O., Toledo—Fame Laundry Co., 2125 Ashland St.—equipment for proposed $41,000 addition to plant.

Okla., Miami—O. T. Dixon—job press and Miller feeder.

Okla., Picher—Picher District Leader—job printing press and Miller feeder.

Pa., Erie—E. Lee—rip saw, bench planer, drilling machine, etc.

Pa., Pittsburgh—Harbison-Walker Refractories Co., Farmers Bldg.—machinery and equipment for proposed $600,000 plant for the manufacture of tile, fire brick and general clay products, at Bessemer, Ala.

R. I., Providence—Textile Finishing & Mchy. Co., 171 Westminster St.—machinery for proposed roll shop and press room.

Tenn., Fayetteville—Bryson Novelty Mfg. Co.—press for printing on wood.

Tenn., Knoxville — Duncan Mchy. Co., Dempster Bldg., 721 North Central Ave., J. G. Duncan, Purch. Agt.—steel derrick, 30 to 50 ton guy type (used); 16, 18 or 20 ft. bull wheel for derrick.

Tex., Archer City—W. C. Young—job printing press, belting, pulleys and shafting (used).

Tex., Austin—Calcasieu Lumber Co., 311 West 2nd St.—7 x 30 in. single planer.

Tex., Dallas—C. C. Pope, 106 Race St.—jointer, planer, bandsaw, shaper and comb saw.

Va., Richmond—Chesapeake & Ohio R.R. Co., 823 East Main St., H. C. Pearce, Dir. Purchases & Stores—20 ton locomotive crane.

Va., Woodstock — H. B. Chapman—machinery for polishing quartz.

Wis., Appleton—S. W. Murphy, 493 College Ave. (manufacturer of paper)—one electric traveling crane, about 65 ft. span.

Wis., Cambria—E. A. Banks—pea canning machinery, hullers, conveyors, belting and shafting for proposed factory at Arlington.

Wis., Cuba—Zinc Hill Mining Co.—mining and milling machinery, also belting and shafting for proposed $50,000 plant.

Wis., Dodgeville—Perkins Bros. (meats and produce)—motor driven refrigeration machinery, several ton capacity.

The Weekly Price Guide

RISE AND FALL OF THE MARKET

Iron and Steel—Pig iron prices stiffer owing to slowdown in production. Structural steel demand growing; lessening in car material requirements. Unfilled plate tonnage high. Tank plates and bridge material fairly active. Price of plates and shapes steady at $2.50 per 100 lb., Pittsburgh; premium of $2 per ton required on early deliveries in many instances. Cold-drawn steel demand more active. Bars firm at $2.40, base, with slightly better demand.

Advances—Copper firm; up ¼c. in New York. Tin prices tending upward; advanced ¾c. in week. Lead steady; no change in price. Foreign zinc market advancing; up 35c. per 100 lb. in New York. Babbitt metal higher in Cleveland, following advances in non-ferrous metals.

Declines—Fabricated brass and copper lower in Cleveland warehouses. Discounts on iron and steel bolts, nuts, screws, washers and rivets, higher in New York. Raw linseed oil, 95c., f.o.b. New York, in 5 bbl. lots, against 96c.; $1.06 in Cleveland, compared with $1.18 per gal. one week ago.

IRON AND STEEL

PIG IRON—Per gross ton—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$29.05@$31.05
Northern Basic	28.17
Southern Ohio No. 2	28.27
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	34.37
BIRMINGHAM	
No. 2 Foundry	25.00@27.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	29.16
Virginia No. 2	32.17
Basic	26.16
Grey Forge	26.16
CHICAGO	
No. 2 Foundry local	30.61
No. 2 Foundry, Southern (silicon 2.25@2.75)	31.01
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	28.77
Basic	27.27
Bessemer	28.77

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	6.75
Cleveland	6.75@7.40
Cincinnati	7.50
New York	5.50@7.00
Chicago	5.00@5.50

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	3.00	4.59	3.75	4.15
No. 12	3.10	4.64	3.80	4.20
No. 14	3.20	4.69	3.85	4.25
No. 16	3.40	4.79	3.95	4.35
Black				
Nos. 17 and 21.	3.70	4.80	4.45	5.05
Nos. 22 and 24.	3.75	4.85	4.50	5.05
Nos. 25 and 26.	3.80	4.90	4.55	5.10
No. 28	3.85	5.00	4.65	5.20
Galvanized	**Pittsburgh**	**New York**	**Cleveland**	**Chicago**
Nos. 10 and 11.	4.00	5.00	4.70	5.35
Nos. 12 and 14.	4.10	5.10	4.80	5.45
Nos. 17 and 21.	4.40	5.40	5.10	5.75
Nos. 22 and 24.	4.55	5.55	5.25	5.90
No. 26	4.70	5.70	5.50	6.05
No. 28	5.00	6.00	5.80	6.35

WROUGHT PIPE (Welded)—The following mill discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

Steel Inches	Black	Galv.	Iron Inches	Black	Galv.
		BUTT WELD			
1 to 3	62	50½	⅜ to 1¼	30	13
		LAP WELD			
2	55	43½	2	23	7
2½ to 6	59	47½	2½ to 4	28	13
7 and 8	56	43½	4½ to 6	28	13
9 and 10	54	41½	7 to 12	26	11
11 and 12	53	40½			
		BUTT WELD, EXTRA STRONG, PLAIN ENDS			
1 to 1¼	60	49½	¾	28	12
2 and 3	61	50½	1 to 1½	30	14
		LAP WELD, EXTRA STRONG, PLAIN ENDS			
2	53	42½	2	23	9
2½ to 4	57	46½	2½ to 4	29	15
4½ to 6	56	45½	4½ to 6	28	14
7 and 8	52	39½	7 and 8	21	7
9 and 10	45	32½	9 to 12	16	2
11 and 12	44	31½			

Warehouse discounts are as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded	48%	34%	55½%	43½%	50%	37%
2½ to 6 in. steel lap welded	44%	30%	53½%	40½%	47%	34%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 15%. Cast iron, standard sizes, 17½% off.

SEAMLESS STEEL TUBING—Following base discounts are on 20 gauge or .035-in., round, cold-drawn tubing, ½-in. to 1-in., O.D., weighing 0.17 lb. to 0.36 lb. per ft. Cutting charge per 100 cuts, $1.50 to $1.58:

O.D. Inches	List Price per ft.	Differential Discount	O.D. Inches	List Price per ft.	Differential Discount
½	$0.09	50%	¾	$0.16	35%
⅝	.11	45%	1	.18	31%
¾	.14	40%			

NOTE—The discounts are to be lowered by the following differentials in the case of regular .10-.20 carbon: 25,000 ft. or over, 83; 15,000 to 25,000 ft., 82; 5,000 to 15,000 ft., 81; 1,000 to 5,000 ft., 80; less than 1,000 ft., 79.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50	6.00	4.50
Spring steel (light) (base)	7.00	6.00	6.00
Coppered Bessemer rods (base)	6.53	8.00	6.55
Hoop steel	5.19	4.66	4.55
Cold rolled strip steel	7.50	8.25	7.25
Floor plates	5.80	5.66	5.80
Cold finished shafting or screw	4.65	3.90	4.55
Cold finished flats, squares	5.15	4.40	5.05
Structural shapes (base)	3.64	3.46	3.40
Soft steel bars (base)	3.54	3.36	3.20
Soft steel bar shapes (base)	3.54	3.36	3.20
Soft steel bands (base)	4.39	3.61	3.95
Tank plates (base)	3.64	3.46	3.30
Bar iron (3.25 at mill)	3.54	3.36	3.20
Tool steel	11.00	....	....
Drill rod (from list)	55%	40@55%	50%

Electric welding wire, New York, 5/32, 8.35c.; ⅛, 7.85c.; 5/32 to ¼, 7.35c. per lb.

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York			14.50
Tin, 5-ton lots, New York			42.50
Lead (up to carlots), St. Louis	6.65	New York	7.37½
Zinc (up to carlots), St. Louis	6.60	New York	7.25

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	26.10	27.00	28.00
Antimony (Chinese), ton spot	8.87½	10.50	8.75
Copper sheets, base	21.25	22.00	23.00
Copper wire (l.c.l.)	16.50	19.25	16.25
Copper bars (l.c.l.)	20.75	22.50	19.50
Copper tubing (l.c.l.)	25.50	27.50	23.00
Brass sheets (l.c.l.)	18.50	23.00	18.75
Brass tubing (l.c.l.)	24.00	28.50	20.50
Brass rods (l. c. l.)	16.75	18.50	15.75
Brass wire (l. c. l.)	19.00	23.00	.....
Zinc sheets (casks)	10.75	10.45	.....
Solder (½ and ¼), (case lots)	29.50	27.75	20.00
Babbitt metal (83% tin)	52.00	53.00	38.00
Babbitt metal (35% tin)	25.00	17.00	16.00
Nickel (ingot and shot)	29.00	.....	35 00
Nickel (electrolytic)	32.00	.....	35.00

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel sheet (base)	57.00
Hot rolled rods, Grade "A" (base)	55.00
Cold drawn rods, Grade "A" (base)	63.00
Copper nickel ingots	37.00
Hot rolled copper nickel rods (base)	45.00
Manganese nickel hot rolled rods "E"—low manganese (base)	57.00
Manganese nickel hot rolled rods "D"—high manganese (base)	60.00

Base price of monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	32.00	Hot rolled rods (base)	40.00
Blocks	32.00	Cold drawn rods (base)	48.00
Ingots	38.00	Hot rolled sheets (base)	42.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	12.00	11.50	12.00
Copper, heavy, and wire	11.50	11.00	11.25
Copper, light, and bottoms	10.00	9.00	10.00
Lead, heavy	5.00	5.00	5.50
Lead, tea	4.00	4.00	4.50
Brass, heavy, yellow	7.50	....	7.00
Brass, heavy, red	9.50	9.50	9.00
Brass, light	6.00	5.00	6.25
No. 1 yellow brass turnings	7.00	6.00	6.75
Zinc	3.75	3.00	3.75

TIN PLATES—American Charcoal—Bright—Per box.

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	20x28, 112 sheets	$23.50	$19.50	$18.50
"A" Grade:				
IC,	20x28, 112 sheets	21.00	17.00	17.00
	Coke Plates—Primes, 20x28 in.			
100-lb.,	112 sheets	14.00	12.60	14.50
	Terne Plates—Small lots, 8-lb. Coating			
IC,	14x20	8.25	6.55	7.40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.10@0.13	$0.15	$0.11
Cotton waste, colored, per lb.	.08@.13	.12	.08
Wiping cloths, 13¼x13¼, per lb.	11.00	36.00 per M	.10
Wiping cloths, 13¼x20½, per lb.	....	52.00 per M	.13
Sal soda, per 100 lb.	1.65	2.25	2.65
Roll sulphur, per 100 lb.	3.85	3.25	3.50
Linseed oil, per gal., 5 bbl. lots.	.95	1 06	1.14
White lead, dry or in oil	100 lb. kegs	New York, 14.00	
Red lead, dry	100 lb. kegs	New York, 14.00	
Red lead, in oil	100 lb. kegs.	New York, 15.50	
Fire clay, per 100 lb. bag		.65	.60
Coke, prompt furnace, Connellsville	per net ton	$5.00@5.50	
Coke, prompt foundry, Connellsville	per net ton	6.00@6.50	

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	40-10%	50-10%	45-5%
1½ and 1¼x3 in. up to 12 in.	15%	50%	50%
With cold punched hex. nuts up to 1 in. diam. (plus std. extra of 10%)	25-10%	$3.50 net	....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	30-10%	3.50 net	$4.00 off
Button head bolts, with hex. nuts	List net	List net	.....
Hex. head and hex. nut bolts	List net	.....	65-5%
Lag screws, coach screws	40-10%	.....	60-5%
Square and hex. head cap screws	60%	70%	70-10%
Carriage bolts, up to 1 in. x 30 in.	30-10%	45%	40-5%
Bolt ends, with hot pressed nuts	40-10%	.....	55%
Tap bolts, hex. head, list plus	35%	.....	.....
Semi-finished nuts, ⅞ and smaller	60%	.....	....
Semi-finished nuts, ¾ and larger	55%	65-10%	80%
Case-hardened nuts	40%	.. ....	.....
Washers, cast iron, ½ in., per 100 lb. (net)	$6.50	$4.00	$3.50
Washers, cast iron, ¾ in., per 100 lb. (net)	5.50	4.00	3 50
Washers, round plate, per 100 lb. Off list	1 50	4.00	3.50 net
Nuts, hot pressed, sq., per 100 lb. Off list	0.50	2.75	2.50
Nuts, hot pressed, hex., per 100 lb. Off list	0.50	2.75	2.50
Nuts, cold punched, sq., per 100 lb. Off list	0.50	2.75	2.50
Nuts, cold punched, hex., per 100 lb. Off list	0.50	2.75	2.50
Rivets:			
Rivets, ⅞ in. dia. and smaller	50-10%	50-10%	60%
Rivets, tinned	50-10%	50-10%	4½c. net
Button heads ⅝-in., ¾-in., 1x2 in. to 5 in., per 100 lb (net)	$5.50	$3.90	$3.75
Cone heads, ditto (net)	5.60	4.00	3.85
1½ to 1¾-in. long, all diameters, *EXTRA* per 100 lb.	0.25	.....	0.15
⅝ in. diameter *EXTRA*	0.15	.....	0.15
½ in. diameter *EXTRA*	0.50	.....	0.50
1 in. long, and shorter *EXTRA*	0.50	.....	0.50
Longer than 5 in. *EXTRA*	0.25	.....	0.25
Less than 200 lb. *EXTRA*	0.50	.....	0.50
Countersunk heads *EXTRA*	0.35	.....	$3.70 base

Lard cutting oil (50 gal. bbl.) per gal.	$0.55	$0.50	$0.67½
Machine lubricant, medium-bodied (50 gal. bbl.), per gal.	0.297	0.35	0.40
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 2c. per sq.in., per ply:			
Medium grade	30-10%	30-10%	30-10%
Heavy grade	20-5-2½	30%	20-5-2½%
Rubber and duck:			
First grade	50-10-5%	50-10%	40-10%
Second grade	60-10%	60-5%	60-5%
Abrasive materials—In sheets 9x11 in.,			
No. 1 grade, per ream of 480 sheets:			
Flint paper	$6.30	$5.84	$6.48
Emery paper	9.90	11.00	8.80
Emery cloth	31.12	31.12	29.48
Flint cloth, regular weight, width 3½ in., No. 1 grade, per 50 yd. roll.	4.73	4.28	4.95
Emery discs, 6 in. dia., No. 1 grade, per 100:			
Paper	1.49	1.24	1.40
Cloth	3.38	2.67	3.20

Wis., Dodgeville—G. Williams—mining machinery and equipment, including shafting, drills, etc., for proposed zinc mill at New Diggings.

Wis., Evansville—Rock County, c/o M. L. Paulson, Chn. Bldg. Com.—coal handling machinery, etc., for proposed $40,000 boiler house at Janesville.

Wis., Janesville—Glancy Malleable Corp., c/o L. A. Avery, 14 West Milwaukee Ave. (malleable castings)—several moulding machines and furnaces.

Wis., Madison—Piper Bros. Co., c/o S. Piper, 31 North Pinckney St. — laundry equipment, dryers and ironers; also refrigeration equipment, ice machinery and dish washing machinery for proposed $1,000,000 hotel.

Wis., Madison—W. Swenson, 7 West Main St.—gasoline storage tanks and pumps for proposed filling station.

Wis., Manitowoc—E. R. Herman, 1402 Hamilton St.—ash hoists and ash handling machinery.

Wis., Marshfield—Roddis Lumber & Veneer Co.—belt driven conveying machinery.

Wis., Milwaukee—Banner Iron & Wire Wks., 928 Winnebago St., C. J. Klinka, Purch. Agt.—hack saw (used).

Wis., Milwaukee—E. M. Buchrach, 1684 11th St. (millwork)—one large belt sander.

Wis., Milwaukee — O. J. Hassler, 5707 Washington Blvd. (carpentry and millwork) —one 6 to 10 in. sticker.

Wis., Milwaukee—B. C. Wait, 101 South Water St. (steel castings)—one large electric furnace.

Wis., North Milwaukee—W. Scholtka, 36th St. and Wallace Ave. (woodwork)—one rip saw to rip up to 2 in. material.

Wis., Pewaukee—Pewaukee Press—job press.

Wis., Platteville—R. Karrman & E. Richards Co.—rock crushing machinery, including crushers, rollers, screens, hoist, drills, elevator machinery and bucket conveyors.

Wis., Spooner—D. W. Caldwell (creamery)—churn, cream separator, weighing machine, tester, belting and shafting.

Wis., Watertown—Perfection Table Slide Co., 603 Clyman St., W. C. Schultz, Mgr.—finger jointing machine, grooving machine and conveyors.

Alta., Calgary — Highwood Petroleum & Natural Gas Co., Ltd., H. G. Nolan, Purch. Agt.—pumping, assaying, refining, distilling and extracting machinery.

Man., Winnipeg—Western Steel Products, Ltd., Desautels St. Bon St. along tracks of Canadian National Ry., H. C. McMartin, Purch. Agt.—machinery for the manufacture of metal products.

N. B., Sackville—Enterprise Fdry. Co., Ltd. (stoves, etc.)—equipment.

Ont., Brantford—Dustless Sifters, Ltd., I. Lunenfeld, Purch. Agt.—machinery for the manufacture of ash sifters, fuel saving devices, hardware, etc.

Ont., Chesley—W. and C. Window Regulator Co., R. J. Ranney, Mgr.—machinery and equipment for proposed $100,000 plant for the manufacture of patent window regulator.

Ont., Ford—Ford Motor Co. of Canada—special equipment for proposed $500,000 heat treating plant.

Ont., Kirkland Lake—Lake Shore Mines, Ltd., R. C. Coffey, Mgr.—mill, 300 ton daily capacity.

Ont., Kirkland Lake—Teck-Hughes Gold Mines, Ltd., D. L. H. Forbes, Mgr.—mill.

Ont., Porcupine — Goldale Mines, Ltd., A. H. Britton, Secy.—hoisting equipment (new).

Ont., Thorold—Daily News Print Corp., W. Curtis, Purch. Agt.—equipment for proposed $3,000,000 paper plant at North Tonawanda, N. Y.

Ont., Toronto — Canadian Westinghouse Co., Traders Bank Bldg.—forges and equipment for proposed $300,000 foundry at Hamilton.

Ont., Toronto—Castle Tretheway Mines, Ltd., Standard Bank Bldg., H. G. Laut, Secy.—equipment, including mill, for Gowganda mine.

Ont., Vineland—S. T. Wayman—crushers, mixers, molds, etc., for proposed $50,000 cement and stone products plant.

Que., Hudson—Laval Shoe Mfg. Co., Ltd., W. H. Cote, Purch. Agt.—machinery for tanning, dyeing and manufacturing shoes, harness, traveling bags, etc.

Que., Montreal—Lachapelle Eng. Co., 137 McGill St. (electrical mechanical appliances and supplies)—air hammer drill complete with 4 drills.

Que., Montreal—E. B. Myers Co., Ltd., c/o F. Callaghan, 222 St. James St.—machinery for the manufacture of radio equipment.

Que., St. Hyacinthe—L. P. Morin & Fils, 2 St. Joseph St.— woodworking equipment.

Que., St. Hyacinthe — A. Parent, St. Liboive St. (woodworking)—moulder and equipment.

Que., St. Hyacinthe—L. Robert, 35 Concorde St.—automatic compressor, etc., for garage.

Que., St. John's—Latour & Dupuis—equipment for sash and door factory.

Que., St. Lue—A. D. Girard—forge and other equipment for blacksmith shop.

Que., St. Pierre—E. Daunais—blacksmith shop equipment.

Que., St. Timothee—R. Montpetit—equipment for blacksmith shop.

Metal Working Shops

Calif., Los Angeles—The Baldwin Motor Co., 1201 South Figueroa St., is having plans prepared for the construction of a 4 story, 75 x 200 ft. garage. W. D. Lee, Sun Drug Bldg., Los Angeles, Archt.

Calif., Los Angeles — The Los Angeles Motor Bus Co., Railway Bldg., has had plans prepared for the construction of a 2 story garage and office building on North Virgil St. Estimated cost $60,000. Private plans.

Calif., Los Angeles — L. R. Lurie, 315 Montgomery St., San Francisco, is having plans prepared for the construction of a 2 story auto stage terminal on Los Angeles and 6th Sts., here. Estimated cost $200,000. O'Brien Bros., Inc., 315 Montgomery St., San Francisco, Archts. Pickwick Auto Stage Co., 683 Market St., San Francisco, lessee.

Calif., Oakland—The California Wire Cloth Co., 1001 22nd Ave., awarded the contract for the construction of a 1 story factory. Cost will exceed $40,000.

Calif., Oakland—The Chevrolet Motor Co. of California, Foothill Blvd. and 69th Ave., is having plans prepared for the construction of a 1 story addition to its plant. Cost will exceed $150,000. Private plans.

Calif., Oakland—J. R. Kaelin, 1933 5th Ave., awarded the contract for the construction of a 1 story garage, laundry and boiler house on 23rd Ave. and Boehmer St. Estimated cost $56,125.

Calif., San Francisco — J. Pasqualetti, Humboldt Bank Bldg., awarded the contract for the construction of a 2 story garage on Market St. near 15th St. Estimated cost $40,000. Noted Sept. 6.

Calif., San Francisco—W. M. Schlaes, c/o Cahill Bros., contractors, 110 Sutter St., awarded the contract for the construction of a 2 story (ultimately 4 story) garage on Ellis St. near Mason St. Estimated cost $75,000.

Md., Baltimore—The Gas & Electric Co., Constitution and Monument Sts., plans to build a 1 story, 118 x 169 ft. general repair shop for machinery, automobiles, etc. Estimated cost $69,590.

Mass., Woburn—J. J. Grothe Co., 12 Everett St. (manufacturer of wagons), plans to build a 1 story, 100 x 200 ft. machine and woodworking shop, an addition to present plant.

Mass., Worcester—J. Nagle, Harrison St., plans to build a 1 story, 30 x 40 ft. machine shop.

Mich., Detroit — The Caughey-Jossman Co., 5075 Grand River Ave., awarded the contract for the construction of an 80 x 286 ft. garage and service building, also a 100 x 115 ft. sales room on Grand River Ave. near Warren Ave. International Motor Truck Co., lessee.

Mich., Union City—The Ford Garage Co. plans to build a garage and service station. Estimated cost $75,000. Engle & Stanton, owners.

Miss., Vicksburg—The Alabama & Vicksburg R.R. awarded the contract for the construction of a 64 x 208 ft. car repair shop on Cherry St. Estimated cost $57,000.

Mo., St. Louis—C. Ickenroth, 1012 Yale Ave., awarded the contract for the construction of a 1 story, 40 x 98 ft. garage at 6806-8 Clayton Ave. Estimated cost $25,000.

N. Y., Jamestown—The King Motor Sales Co., West 4th St., plans to build a garage and service station. Estimated cost $125,000. H. C. King, Pres.

N. Y., North Tonawanda — The Daily News Print Corp., Thorold, Ont., is having plans prepared for the construction of a paper plant, including a 93 x 380 ft. machine room, a 130 x 145 ft. heater room and a 150 x 400 ft. main building, here. Estimated cost $3,000,000. Private plans.

N. Y., Tottenville—The Nassau Smelting & Refining Wks., Ltd., 603 West 29th St., New York, awarded the contract for a group of plant buildings, here. Estimated cost $100,000.

O., Cleveland—The Brush Garage Co., c/o Watson Co., Archts., 4614 Prospect Ave., awarded the contract for the construction of a 2 story, 110 x 110 ft. garage on Prospect Ave. near East 55th St. Estimated cost $100,000. Noted Sept. 6.

O., Cleveland—The Cleveland Cap Screw Co., 2921 East 79th St. awarded the contract for the construction of a 2 story, 66 x 95 ft. addition to its factory. Estimated cost $40,000.

O., Cleveland—H. D. Koblitz, Osborn Bldg., has had plans prepared for the construction of a 1 story, 89 x 116 ft. garage and commercial building on East 55th St. and Cedar Ave. Estimated cost $50,000. R. M. Hulett, 1104 Prospect Ave., Cleveland, Archt.

O., Cleveland—I. G. Kohn, 640 Guardian Bldg., has had plans prepared for the construction of a 1 and 2 story, 60 x 126 ft. garage and commercial building at 2027 East 105th St. Estimated cost $50,000. Lehman & Schmidt, Electric Bldg., Cleveland, Archts. Noted Aug. 2.

O., Cleveland—Thorsell Bros., Mayfield and Sheffield Rds., awarded the contract for the construction of a 1 story, 50 x 100 ft. garage and repair shop. Estimated cost $40,000.

O., Toledo — Baker Bros., Post St., awarded the contract for the construction of a 2 story, 80 x 112 ft. machine shop. Estimated cost $40,000.

O., Toledo—The Page Dairy Co., Wade and Knapp Sts., is receiving bids for the construction of a 1 story, 80 x 100 ft. garage on Wade and Williams Sts. Estimated cost $50,000. Mills, Rhines & Bellman, 1234 Ohio Ave., Toledo, Engrs. and Archts.

R. I., Providence—Lockwood, Greene & Co., Engrs. and Archts., 24 Federal St., Boston, will soon award the contract for the construction of a 2 story, 61 x 110 ft. roll shop and a 1 story, 76 x 121 ft. press room for the Textile Finishing Mchy. Co., 171 Westminster St., here. Estimated cost $200,000.

S. C., Greenville—J. E. Sirrine & Co., Engrs., are receiving bids for the construction of a 60 x 120 ft. factory for the manufacture of reeds, loom harness, drop wires, etc., for the Steele-Heddle Mfg. Co.

W. Va., Northfork—The Community Garage is having plans prepared for the construction of a 2 story, 106 x 106 ft. sales and service building. S. S. McNeil, Pres. L. P. Richards, Crumpler, Archt.

Wis., Cuba—The Zinc Hill Mining Co. will build a 1 story, 75 x 120 ft. milling plant. Estimated cost $50,000.

Wis., Elkhorn—H. Wheeler plans to build a 2 story garage and repair shop. Estimated cost $40,000. Engineer or architect not selected.

Wis., Manitowoc—The Grimm Aluminum Casting Co., South 21st St., awarded the contract for the construction of a 1 story, 50 x 84 ft. foundry on 21st and Franklin Sts. Estimated cost $40,000. Noted Aug. 16.

Wis., Milwaukee—The Boston Store, 319 Grand Ave., plans to build a 1 story garage on Virginia St. Estimated cost $50,000. N. Stone, Pres. Engineer or architect not selected.

Wis., Milwaukee—The Luick Ice Cream Co., 183 Ogden Ave., is having plans prepared for the construction of a 4 story, 120 x 120 ft. garage on Van Buren St. Leenhouts & Guthrie, 424 Jefferson St., Milwaukee, Archts.

Ont., Chesley—The W. and C. Window Regulator Co. plans to build a plant for the manufacture of a patent window regulator for automobiles, boats, street cars, railway cars, etc. Estimated cost $100,000. R. J. Ranney, Mgr.

Ont., Collingwood—The Canadian Postal Lock Nut & Bolt Co., awarded the contract for the construction of a factory. Estimated cost $60,000. F. A. Bassett, Pres. Noted Dec. 14, 1922.

Ont., Ford—The Ford Motor Co. of Canada awarded the contract for the construction of a 1 story, 144 x 200 ft. heat treating plant. Estimated cost $500,000. Noted July 26.

Ont., Hamilton—The Canadian Westinghouse Co., Traders' Bank Bldg., Toronto, is having plans prepared for the construction of a 1 story, 205 x 550 ft, foundry on Aberdeen St., W., here. Estimated cost $300,000. B. H. Prack, 50 Bay St., Toronto, Archt.